

NUMBER SENSE

3 – 4

Number Sense

What All Students “Should Know”

3 – 4

1. Counting and grouping strategies.

Clarifications:

All students should know how to:

- Connect number words and numerals to quantities that they represent.
- Group and count objects by 2's, 3's, 5's, 10's etc.
- Choose appropriate grouping strategies to count larger groups of numbers.
- Count money i.e. 5's, 10's, 25's.

2. Mental computation and estimation strategies.

Clarifications:

All students should know how to:

- Group and choose an appropriate mental computation strategy which could include:
 - ♦ Find compatible numbers $(75 + 29 = 75 + 25 + 4)$
 - ♦ Adjust for nines $(9 + 6 = 10 + 5); (29 + 45 = 30 + 45 - 1)$
 - ♦ Chunk or group known parts $52 + 48 \rightarrow 50 + 40 + (2 + 8) = 100$

$$3 + 3 + 6 + 7$$

$$\begin{array}{c} \diagup \quad \diagdown \\ \diagdown \quad \diagup \\ 9 + 10 = 19 \end{array}$$

$$36 + 27$$

$$\begin{array}{c} \diagup \quad \diagdown \\ \diagdown \quad \diagup \\ 50 + 13 = 63 \end{array}$$

- Choose an appropriate estimation strategy to estimate which could include:

- ♦ Front-end

$$\begin{array}{r} \boxed{3}25 \\ +571 \\ \hline \boxed{8}00 \\ \hline \boxed{} \end{array}$$

- ♦ Rounding

$$\begin{array}{r} 78 \rightarrow 80 \\ +32 \rightarrow 30 \\ \hline 110 \end{array}$$

- ♦ Find a range i.e. 647

$$\begin{array}{r} +328 \\ \hline \end{array}$$

(Between 900 and 1000)

- ♦ Determine a reasonable estimate to describe a quantity (i.e. how many marbles in a jar?)

3. Place value.

Clarifications:

All students should know:

- How to read and write multi-digit numbers (through billions) in standard form and words.
- How to represent numbers using models, and/or drawings.
- The magnitude (size) of a number with emphasis on powers of 10 (hundreds, thousands).
- A numeral's value according to its place.
- How to recognize coins and bills.
- How to identify the value of coins and bills.
- How to use the appropriate money symbols.
- How to arrange a set of numbers from highest to lowest or lowest to highest.

4. Basic computation facts of addition, subtraction, multiplication and division with whole numbers.

Clarifications:

All students should know:

- The meaning of addition/subtraction using real objects.
- How to represent quantities using written symbols for addition and subtraction.
- Multiple strategies for solving basic facts for addition (doubles, doubles + 1, or - 1, counting on, adjust for nines).
- The zero property for addition and subtraction ($6 + 0 = 6$ and $6 - 0 = 6$).
- The commutative property ($2 + 3 = 3 + 2$).
- The associative property ($2 + 3 + 5 = 2 + (3 + 5)$).
- How to use inverse operations for addition and subtraction to solve problems ($3 + 2 = 5$ and $5 - 2 = 3$).
- The meaning of multiplication/division using real objects.
- How to represent quantities for multiplication/division using written symbols.
- Multiple strategies for solving basic facts for multiplication (repeated addition, array, grouping).
- The zero property for multiplication and division.
 $6 \times 0 = 0$ You cannot divide by 0.
- The commutative property for multiplication ($2 \times 3 = 3 \times 2$).
- The associative property for multiplication ($2 \times 3 \times 4 = 2 \times (3 \times 4)$).
- How to use inverse operations.
 $4 \times 5 = 20$ $20 \div 5 = 4$

5. Addition and subtraction of fractions with like denominators.

Clarifications:

All students should know:

- The meaning of fractions as a part of a whole (i.e. halves, fourths, and thirds).
- The meaning of fractions as a part of a set.
- The meaning of mixed numbers.
- Fractional benchmarks of 0, $\frac{1}{2}$, 1 (i.e. $\frac{1}{3}$ is closer to $\frac{1}{2}$ than 0).
- How to add fractions with like denominators ($\frac{1}{3} + \frac{1}{3} = \frac{2}{3}$).
- How to subtract fractions with like denominators ($\frac{4}{5} - \frac{2}{5} = \frac{3}{5}$).

6. U.S. customary and metric units of measure.

Clarifications:

All students should know:

- U. S. customary units of measure.
 - ◆ Distance: inch, foot, yard, mile.
 - ◆ Capacity: cup, pint, quart, gallon.
 - ◆ Mass: ounces, pounds.
- Metric units of measure:
 - ◆ Distance: centimeter, meter, kilometer.
 - ◆ Capacity: milliliter, liter, kiloliter.
 - ◆ Mass: grams, kilograms.
- Which unit of measure is appropriate for the task.
- How to reasonably estimate using an appropriate unit of measure.

7. The appropriate use of calculators.

Clarifications:

All students should know how:

- To use a calculator to determine whether an answer is reasonable.
- To use the “constant” feature on the calculator for repeated addition, repeated subtraction, multiples, etc.
- A calculator could be used to work with larger numbers than students’ computational skills allow.
- To use a calculator to assist with problem solving when computation is not the focus of the lesson.

Number Sense
What All Students “Should Do”
3 – 4

Written Benchmark: A

Model, explore, develop, and explain number operations for whole numbers.

Problem 1:

Process Standards: 1.6, 2.1, and 3.3

Together Bill and Sara have collected 24 rocks. They want to display these rocks in a rectangular arrangement. Use 24 square tiles to help you construct different rectangular arrangements. Draw all the possible arrangements that could be made.

Solution Notes: Possible arrangements for the 24 square tiles.

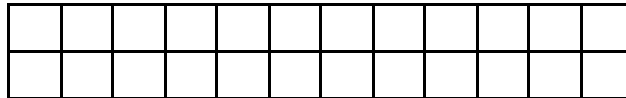
1 X 24,

24 X 1



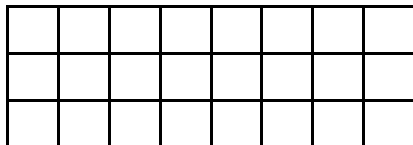
2 X 12,

12 X 2



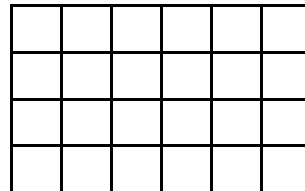
3 X 8,

8 X 3



4 X 6,

6 X 4



Prerequisites:

Students should know:

1. How to make a rectangular array model for multiplication.
2. Grouping and counting strategies.

Problem 2:**Process Standards: 1.6, 2.1, and 3.3**

A photographer needs to display 25 photos in a rectangular arrangement. Draw all the possible arrangements the photographer could use having 3 rows, 4 rows, or 5 rows. Write a sentence to explain which arrangement would allow the photographer to display the photographs without leftovers.

Solution Notes:**4 rows –**

•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•

● One photo is left over.

3 rows –

•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•

● One photo is left over.

5 rows –

•	•	•	•	•
•	•	•	•	•
•	•	•	•	•
•	•	•	•	•
•	•	•	•	•

This arrangement allows all 25 photos to be displayed.

Prerequisites:

The student should know:

1. Grouping and counting strategies.

Number Sense

What All Students “Should Do”

3 – 4

Written Benchmark: B
Use technology to explore numbers.

Problem 1:

Process Standards: 1.4, 2.7, and 3.3

Your calculator will display 4's and 7's, but the 4 and 7 keys are not working today. Using any of the other keys on your calculator, how can you make the number 147 appear? Write the steps you followed to reach 147.

Solution Notes:

Answers may vary. Possible solutions:

$$100 + 30 + 10 + 5 + 2$$

$$50 + 50 + 50 - 3$$

$$100 + 10 + 10 + 10 + 10 + 6 + 1$$

$$100 + 50 - 1 - 1 - 1$$

$$100 + 50 - 3$$

Problem 2:

Process Standards: 1.4, 2.7, and 3.3

Enter the number 365. Enter an operation and a number to change the display to 305. Write the number sentence you used to change the 6 to a 0.

Solution Notes:

Answers may vary. Possible solutions:

$$365 - 60 = 305 \quad \text{or} \quad 365 - 30 - 30 = 305$$

Prerequisites:

Students should know:

1. Place values of 1's, 10's, and 100's.
2. Addition and subtraction strategies.

Problem 3:**Process Standards: 1.4, 1.6, and 2.7**

Use your calculator and hundreds chart to demonstrate the following problem. Color the number on the hundreds chart, that appears on your calculator. Enter on the calculator:

0	+	3	=	=	=
---	---	---	---	---	---

Predict which number will appear after striking the

=

 5 more times.

Tell in a sentence what counting pattern you saw on your hundreds chart that helped you predict the number.

(These directions apply to the TI 108 calculator. If you are using another brand of calculator, follow the directions it specifies for using the constant feature.)

Solution Notes:

24 is the 5th number. You are counting by 3's.

Prerequisites:

Students should know:

1. The use of a calculator.
2. Patterns on a hundreds chart.
3. Patterns in numbers.
4. Place value of 1's, 10's, 100's.

Number Sense

What All Students “Should Do”

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Written Benchmark: C

Use physical models and real-world experiences
to construct number meanings.

Problem 1:

Process Standards: 1.8 and 3.3

You rolled a die three times and the numbers 6, 3, and 4 appeared. Using each number only once, write all the possible 3 digit numbers. Underline the largest number.

Solution Notes:

634	436	364
<u>643</u>	463	346

Prerequisites:

Students should:

1. Be able to compare numbers.
2. Have knowledge of 1's, 10's and 100's place value.

Problem 2:

Process Standards: 2.1 and 2.3

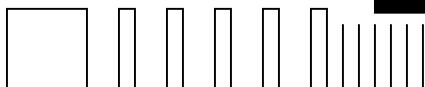
Using base ten blocks, bundles of straws, bean-sticks or other base ten counting materials, represent the number 156. Sketch and label your representation in the box below.

Solution Notes:

Base ten blocks or bean sticks:



Straws:



Problem 3:**Process Standards: 3.3 and 4.1**

The chart below shows the number of leaves that a group of students collected on a nature walk. Identify three different ways to count the number of leaves collected. Describe each way in a number sentence in the box below.

○	○	○	○	○	○				
○	○	○	○	○	○				
○	○	○	○	○	○				
○	○	○	○	○	○				
○	○	○	○	○					
○	○	○	○	○					
○	○	○	○	○					
○	○	○	○	○					
○	○	○	○	○					
○	○	○	○	○					

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Solution Notes:

Accept any valid answer. Possible solutions:

$$25 + 25 + 4$$

$$10 + 10 + 10 + 10 + 10 + 4$$

$$50 + 4$$

$$5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 + 4$$

Two groups of 25 plus 4.

Five groups of 10 plus 4.

Fifty plus 4.

Ten groups of 5 plus 4.

Number Sense
What All Students “Should Do”
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Written Benchmark: D

Demonstrate an understanding of our numeration system
by relating counting, grouping, and place value concepts.

Problem 1:

Process Standards: 1.6, 3.6, and 4.1

Look at the chart below. Find the numbers that would be in each of the shaded boxes. Describe a pattern, other than counting by ones, that could be used to predict the shaded number.

301	302	303	304	305	306	307	308	309	310
311		313	314		316		318	319	320
					326				
	332						338	339	340

Solution Notes:

The shaded numbers would be 324, 328, and 336. Students may notice that each row increases by one ten. Students may also mention 324 and 328 could be found by counting backward or forward by 2's. Accept any reasonable explanation.

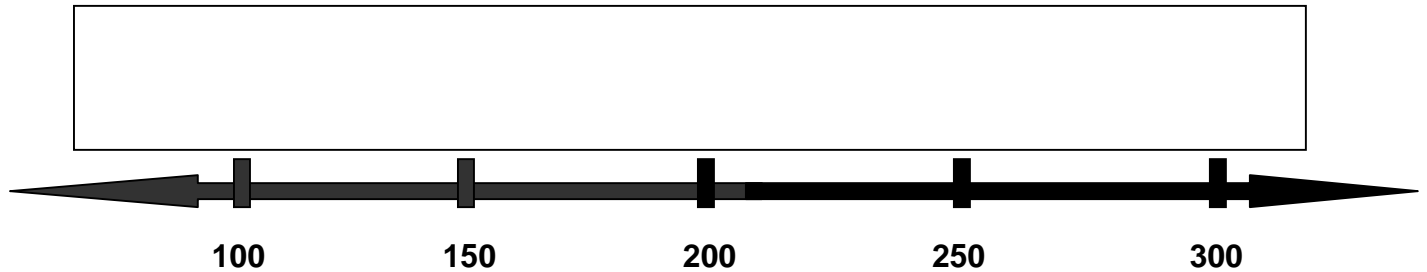
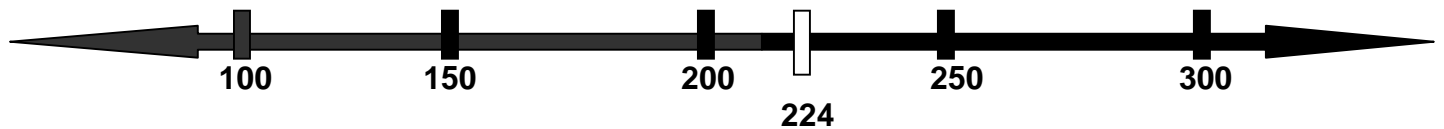
Prerequisites:

The student should:

1. Understand counting patterns on a 100 chart.
2. Have knowledge of 1's, 10's, and 100's.

Problem 2:**Process Standards: 1.6, 3.3, and 4.1**

On this number line, mark the location for 224. In a sentence, explain how you knew where to place your mark.

**Solution Notes:**

224 is almost one-half way between 200 and 250 because 225 is one-half way. My mark is just less than one-half of the way between 200 and 250.

Prerequisites:

Students should:

1. Be able to compare numbers.
2. Have knowledge of 1's, 10's, and 100's.

Number Sense
What All Students “Should Do”
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Written Benchmark: E

Utilize number sense to develop number meanings
and explore number relationships.

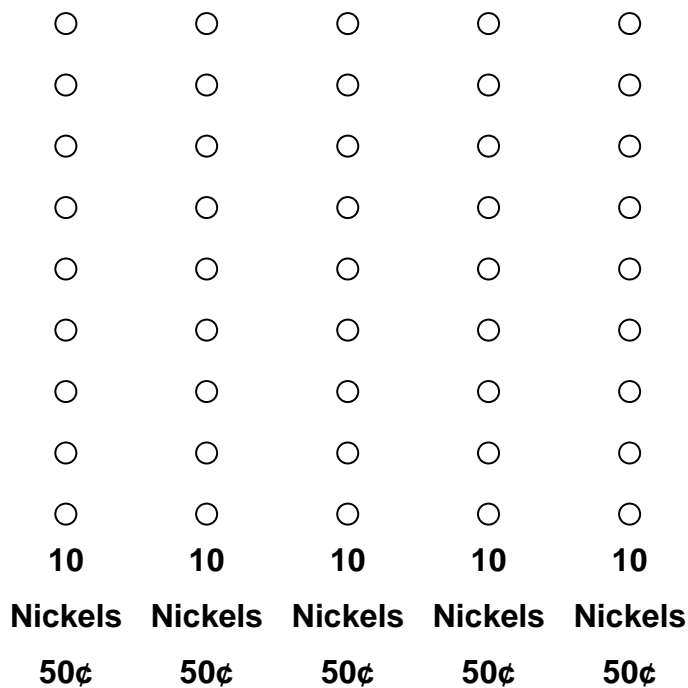
Problem 1:

Process Standards: 1.6, 3.3, and 4.1

Your teacher has given you 50 nickels. It is almost recess time. Organize these nickels so that you can count them quickly. Sketch and describe in a sentence how you organized your nickels. How much are the 50 nickels worth?

Show your work here!

Solution Notes:



The total is \$2.50.

I put my nickels in stacks of 10. Each stack was worth 50¢ so I counted 50¢ five times.
Other Possible Answers: Illustrate 10 stacks of 5.

- ☐ I put my nickels in 10 stacks of 5. Each stack was 25¢.
- ☐ I had \$2.50 when I counted 10 groups of 25.
- ☐
- ☐
- ☐

25¢

Accept any grouping that children can justify other than counting by fives.

Prerequisite:

Students should:

1. Be able to compare numbers.
2. Have knowledge of value of coins.

Number Sense
What All Students “Should Do”
3 – 4

Written Benchmark: F

Use a variety of mental computation and estimation strategies to solve specific problems.

Problem 1:

Process Standards: 1.10, 3.3, and 4.1

The media specialist wants to order books for the library. One order will cost \$28.74. The second order will cost \$79.16. Estimate the total cost for both orders. Will the sum be over or under \$100.00? In a sentence, explain how you determined if the sum would be over or under \$100.00.

Solution Notes:

The order will be over \$100.00. Students might round the numbers to \$30 and \$80 giving them an estimate of \$110. Students might also add the front digits getting an estimate of \$90, and then adjust up for the \$8 and \$9. This method will still give an answer over \$100.

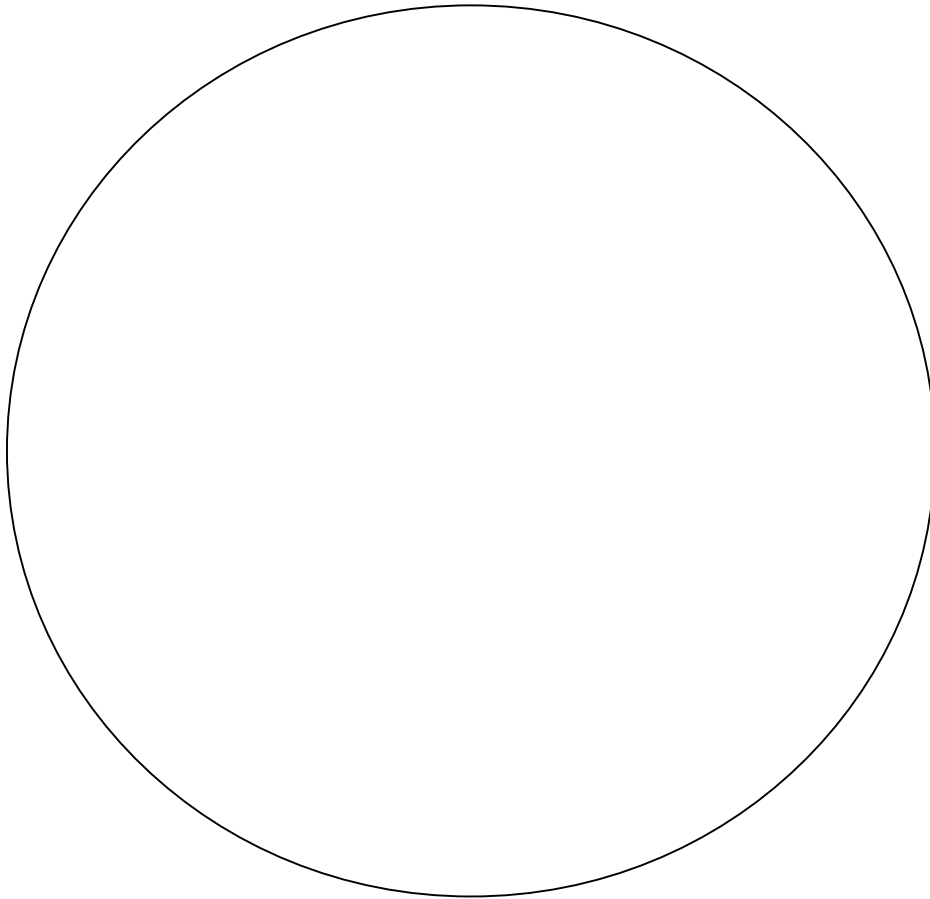
Prerequisites:

Students should know:

1. Place value for 1's, 10's, and 100's.
2. Estimation strategies.
3. Addition methods.

Problem 2:**Process Standards: 1.6, 3.3, and 4.1**

This circle has a diameter of 6 inches. Estimate how many pennies will fill the circle. Write sentences to explain your estimate.

**Solution Notes:**

Accept any reasonable answer that includes a strategy such as sampling, grouping, etc.

Prerequisites:

Students should know:

1. Sampling strategies.
2. Place value for 1's, 10's, and 100's.
3. Counting and grouping strategies.
4. The meaning of estimation.

Number Sense

What All Students “Should Do”

3 – 4

Written Benchmark: G

Demonstrate an understanding of the attributes of length, capacity, weight, area, volume, time, temperature, and angle.

Problem 1:

Process Standards: 1.2, 2.1, and 4.1

Estimate the number of jumping jacks you can do in one minute. Time yourself for one minute and count the actual number of jumping jacks that could be done in that length of time. Write a sentence to compare your estimate and the actual results.

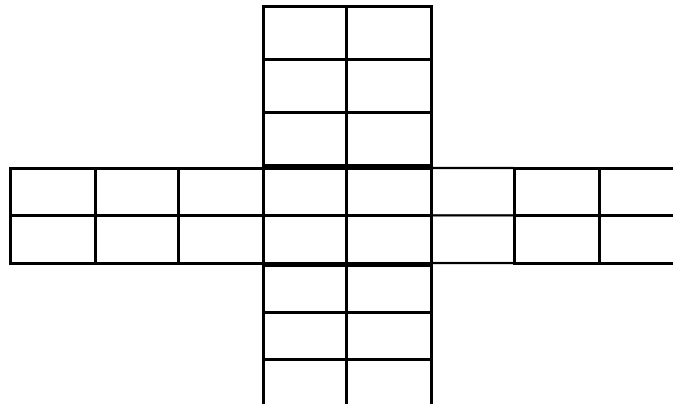
Solution Notes:

Students should mention both the number of their estimate and the actual count. A comparison statement indicating which is larger or smaller should be included.

Problem 2:

Process Standards: 1.6

Cut out the net below. Fold the sides up and tape to form a box. Stack centimeter cubes in the box to find the volume. Write a statement to describe the meaning of volume.



Solution Notes:

Students should find 12 cubes are needed to fill the box. Four cubes cover the bottom layer with two more layers on top of the bottom layer. Students should state that volume is the number of cubes needed to fill a box or 3 - dimensional object.

Problem 3:**Process Standards: 1.2, 1.5, and 4.1**

Read two thermometers and record the temperature.

Thermometer A _____°

Thermometer B _____°

Place one thermometer in the sun and one thermometer in a shady area. After 15 minutes, read each thermometer and record the new temperatures.

Thermometer A _____°

Thermometer B _____°

Write a paragraph to compare and explain the changes in the temperature readings.

Solution Notes:

The temperatures on the thermometers will vary. The thermometer in the sun should show an increase in temperature. The thermometer in the shade should stay the same or decrease slightly.

Problem 4:**Process Standards: 1.6, 3.3, and 4.1**

Using 1 - centimeter graph paper, trace your shoe. Figure the approximate area of your shoe in square centimeters. Justify your measurement by writing sentences or by drawing pictures.

Solution Notes:

Accept any reasonable answer. Look for efficient counting strategies (i.e. finding a rectangle within the outline of the foot). Students should explain how they counted partial squares.

Number Sense
What All Students “Should Do”
3 – 4

Written Benchmark: H

Make and use standard and non-standard measurements in problems and everyday situations.

Problem 1:

Process Standards: 1.4 and 3.3

Mr. Jones wants to decorate a photo album to display photos of his class throughout the year. Given a 6-inch by 4-inch sheet of construction paper as the front cover, ask students how many inches of ribbon will he need to go around the edge of the front cover?

Solution Notes:

$6 + 6 + 4 + 4 = 20$ inches of ribbon.

Problem 2:

Process Standards: 3.3 and 1.5

The Cotton Ball Event – Place a cotton ball at the end of a meter stick. Hold a straw behind the cotton ball. Predict how far you could blow the cotton ball. Blow once through the straw to move the cotton ball. Measure the actual distance the cotton ball traveled in centimeters. Write a sentence to compare the distance of your estimate with the actual distance the cotton ball traveled.

Solution Notes:

Solutions will vary. Students should identify a starting point and accurately use a centimeter ruler to measure the distance. Statements should refer to both measures and indicate the larger value.

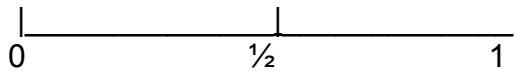
Number Sense
What All Students “Should Do”
3 – 4

Written Benchmark: I

Explore the concepts of fractions, mixed numbers, and decimals
and be able to apply them to problem situations.

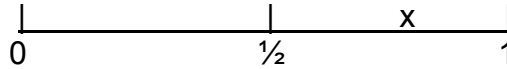
Problem 1:

Process Standards: 1.6, 3.3, and 4.1



On this number line, mark the location of $\frac{4}{5}$. In a sentence, explain why that location is correct.

Solution Notes:



Students should mark a reasonable spot on the number line stating that $\frac{4}{5}$ is closer to 1 than $\frac{1}{2}$.

Problem 2:

Process Standards: 2.1 and 3.3

Three children were given 15 pieces of gum to share. Each child should receive an equal $\frac{1}{3}$ of the gum. Draw a picture to show how the gum could be shared.

Solution Notes:

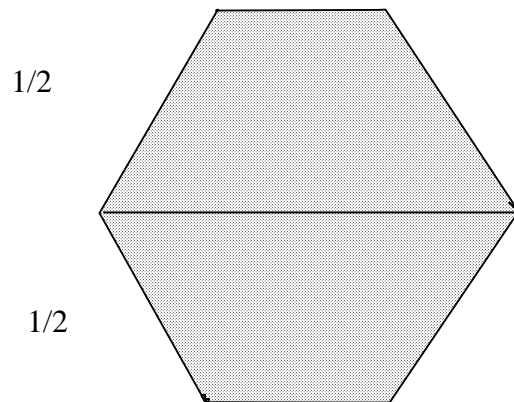


Problem 3:**Process Standards: 1.6, 2.1, 3.3, and 4.1**

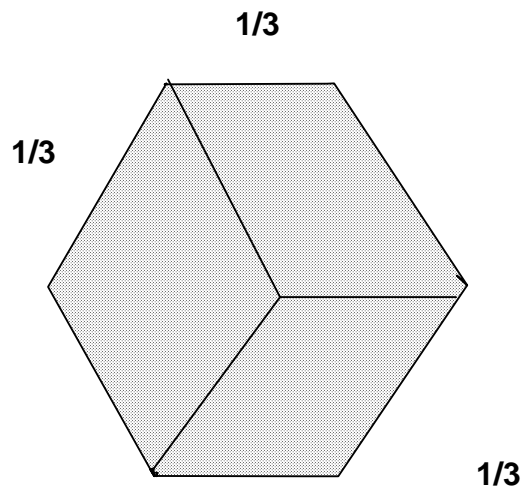
Use your pattern blocks to help you. If the hexagon equals one whole, what fraction of the hexagon is a trapezoid? What fraction of the hexagon is the rhombus? Draw pictures and / or write sentences to justify your thinking.

Solution Notes:

The trapezoid is $\frac{1}{2}$ of the hexagon because 2 trapezoids fit on a hexagon.



A rhombus is $\frac{1}{3}$ of a hexagon because 3 rhombuses will create a hexagon.



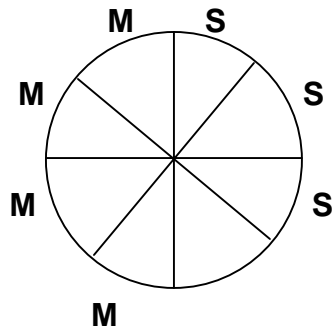
Problem 4:

Process Standards: 1.6, 2.1, 3.3, and 4.1

Sam says that he can eat $\frac{3}{8}$ of a cheese pizza. Maria says that she can eat $\frac{4}{8}$ of a cheese pizza. Draw a picture and write an explanation to explain how many pizzas will be needed.

Solution Notes:

Sam and Maria will need one pizza. They will have $\frac{1}{8}$ of a pizza left over.



GEOMETRIC AND SPATIAL SENSE

3 – 4

Geometric and Spatial Sense

What All Students “Should Know”

3 – 4

1. Standard and nonstandard units of measure.

Clarifications:

All students should know:

- Examples of nonstandard units of measure:
 - ◆ Cubit (length from elbow to end of longest finger)
 - ◆ Toe - to - toe measurement of distance
 - ◆ Pace (walking step) and foot to foot
 - ◆ Hand span, finger to knuckle to finger tip
 - ◆ Pencil, links, or paper clips to measure a distance
 - ◆ Water glasses to measure capacity
 - ◆ Paper clips to measure weight
 - ◆ Beans to find length, area or capacity
- Standard units of measure:
 - ◆ English system
 - Distance - inch, foot, yard, mile
 - Capacity - cup, pint, quart, gallon
 - Mass - ounces, pound, ton
 - ◆ Metric system
 - Distance - centimeter, decimeter, meter, kilometer
 - Capacity - milliliter, liter, kiloliter
 - Mass - gram, kilogram

2. Descriptions of two- and three-dimensional figures.

Clarifications:

All students should know:

- One-dimensional figures:
 - ◆ Lines ◆ Rays ◆ Segment
- Two-dimensional figures:
 - ◆ Circles ◆ Triangles ◆ Polygons
 - ◆ Hexagons ◆ Pentagons ◆ Rectangles including squares
 - ◆ Octagons

- Three-dimensional figures:
 - ◆ Cubes ◆ Cylinders ◆ Cones
 - ◆ Spheres ◆ Prisms ◆ Pyramids
 - ◆ Cylinders
- Apply concepts of turns, flips and slides to two and three - dimensional figures.
- Apply specific attributes of a given shape.
 - ◆ Faces ◆ Similar ◆ Congruent
 - ◆ Vertices ◆ Edges ◆ Symmetrical
 - ◆ Angles
- Methods to compare and contrast one, two, and three- dimensional figures.
- The correct mathematical terms when describing one, two, and three- dimensional figures.

3. Geometric shapes are found in the real world.

Clarifications:

All students should know:

- Geometric shapes in the real world.
- Two-dimensional: length and width with no depth
 - ◆Rectangle - pictures
 - ◆Square - hopscotch squares
 - ◆Circle - stamped happy face
- Three-dimensional: length, width and depth.
 - ◆Sphere - playground ball
 - ◆Cube - random number generator (die)
 - ◆Rectangular Prism – tissue box
 - ◆Cylinder - can
- Recognize turns, flips and slides.
- Identify specific attributes of a given shape.
 - ◆ Faces ◆ Similar ◆ Congruent
 - ◆ Vertices ◆ Edges ◆ Symmetrical
 - ◆ Angles

4. Objects can be located by relative position.

Clarifications:

All students should know relative position might be shown by:

- Finding numbers on a number line
- Locating points on a graph
- Ordinal numbers
- Ordered pairs
- Position words (above, below, beside, etc.)
- Turns, flips and slides

5. The process of measurement.

Clarifications:

All students should know how to:

- Consistently use both standard and nonstandard measuring instruments.
- Use repeated/counting of the units.
- Use units of length, capacity, mass, area, volume, time, and temperature.
- Use time concepts including telling time (5 minute intervals), elapsed time, time zones, sequencing, and patterns on a calendar.

Geometric and Spatial Sense

What All Students “Should Do”

3 – 4

Written Benchmark: A

Describe, model, draw and classify shapes.

Problem 1:

Process Standards: 1.4, 1.6, and 2.1

Use straws and pipe cleaners to construct 3 different geometric shapes. Write a description of each shape that includes the number of faces, vertices, edges and angles. Classify the shape as 2 or 3 dimensional and label with the appropriate mathematical terms.

Solution Notes:

The students may note that the 3-dimensional shapes can stand by themselves because the figure has depth. Possible shapes created could include a cube, a rectangular prism, triangular prism, square, rectangle, etc.

Prerequisites:

Students should:

1. Know definitions of faces, vertices, edges, and angles.
2. Understand and identify 2 and 3 dimensional figures.
3. Know correct mathematical terms and attributes for figures.

Problem 2:

Process Standards: 1.5, 1.7, and 3.5

On index cards, write descriptions of geometric figures with specific attributes such as right triangle, octagon, equilateral triangle, etc. Also include one description that is impossible to draw such as an equilateral right triangle, or a quadrilateral with only 3 right angles. Work in pairs. One student draws the described shape. Students then reverse roles. Each student should have at least one impossible design.

Solution Notes:

Students' drawings should clearly represent directions read. When students encounter a problem that cannot be solved, they may need to explain why the design is not possible.

Extensions:

Have the students create their own shapes and write descriptions for designing the shapes using correct mathematical terms.

Prerequisites:

Students should know:

1. Correct mathematical terms for shape names.
2. Specific attributes for the geometric shapes.
3. Descriptions of angles (i.e. right angle, greater than a right angle, less than a right angle.)

Geometric and Spatial Sense

What All Students “Should Do”

3 – 4

Written Benchmark: B

Investigate and predict the results of combining, subdividing, and changing shapes.

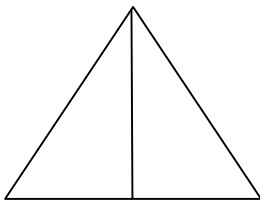
Problem 1:

Process Standards: 1.1, 1.6, and 3.1

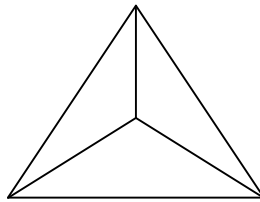
The students are given an equilateral triangle and told to divide it into 2 and 3 equal parts. Divide the triangle to represent these equal divisions. Given a different equilateral triangle, show whether or not the equilateral triangle can be divided into 4 equal parts. Justify your answer.

Solution Notes:

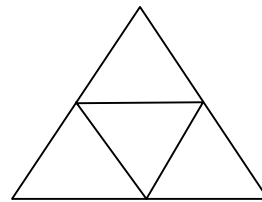
An equilateral triangle divided into:



2 parts



3 parts



4 parts

Prerequisites:

Students should:

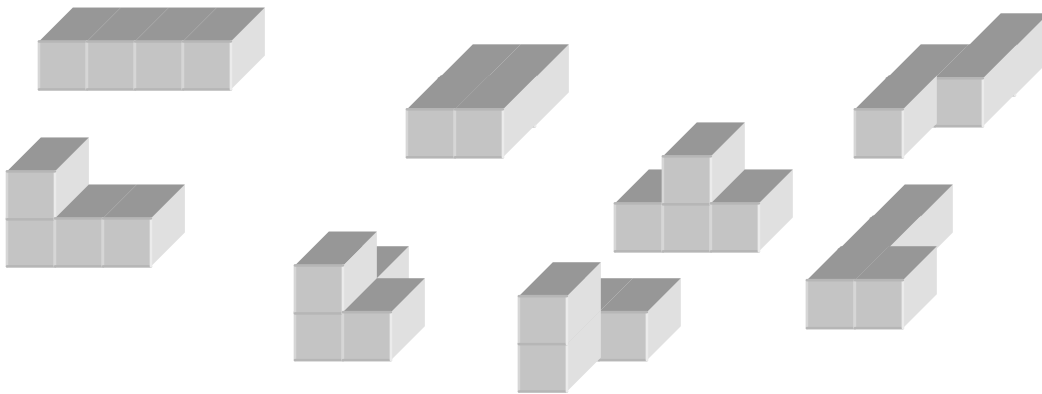
1. Understand the term equal divisions.
2. Know and identify equilateral triangles.

Problem 2:**Process Standard: 1.6**

Predict how many different shapes you could create using 4 cubes. Each cube must touch the entire face of another cube. If you can turn it, flip it or lay it down and it resembles another shape, it cannot count. Now use the cubes to build your designs. Draw the different shapes you can create. How close was your prediction to your actual findings?

Solution Notes:

Assure the students the sketches do not have to be perfect. These are 8 acceptable situations.

**Prerequisites:**

Students should:

1. Understand the concepts of turns, flip, and slide.

Geometric and Spatial Sense

What All Students “Should Do”

3 – 4

Written Benchmark: C
Visualize, draw, and compare shapes.

Problem 1:

Process Standard: 3.3

The teacher will instruct the students to select an object in the classroom to represent each 3 dimensional figure (cube, cone, pyramid, cylinder, sphere, and rectangular prism). What objects can be found? Draw the shapes found and label the figures with the appropriate mathematical terms.

Solution Notes:

Possible Solutions—

- ◆ Sphere: globe, playground ball, basketball, and baseball
- ◆ Cylinder: tennis ball can, chalkboard pointer
- ◆ Cube: die, notepad, block
- ◆ Rectangular Prism: tissue box, shoebox, book
- ◆ Cone: party hats, pylon cone
- ◆ Pyramid: wooden block

Prerequisites:

Students should know:

1. The properties of 3-dimensional figures and apply the correct mathematical terms: cylinder, cone, sphere, rectangular prism, and cube.

Problem 2:




Process Standards: 1.8 and 2.2

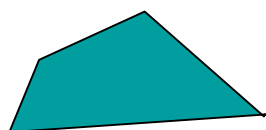
Draw a three-sided and a four-sided shape in the response box below. Write a description of each shape using as many correct mathematical terms as possible. Compare and contrast the two shapes using the same mathematical terms.

Response Box

Solution Notes:

The three-sided shape will be a \triangle (triangle).

The four-sided shape could be    .

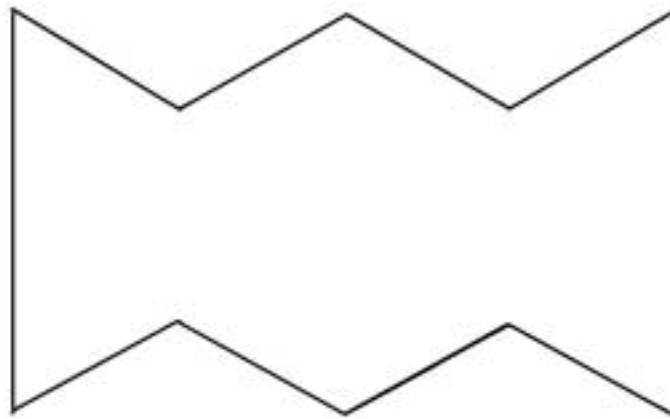


Children should draw a four-sided figure (quadrilateral) similar to those shown above (square, rhombus, rectangle, parallelogram, trapezoid, quadrilateral, or kite). Descriptions should include number and length of sides, angles, and /or vertices.

Problem 3:

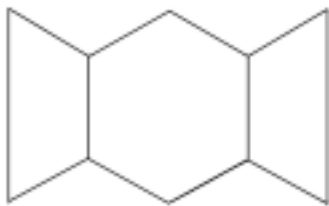
Process Standards: 1.8 and 2.1

Using pattern blocks, ask the students to fill the outline using 2 different shapes, 3 different shapes, and 4 different shapes. Trace their solutions showing how they placed the different pattern blocks.

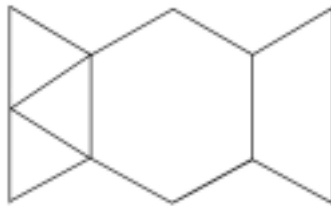


Solution Notes:

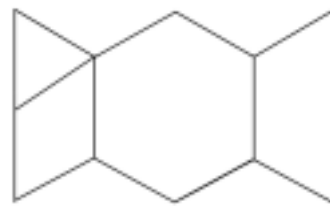
Accept any valid solutions. Possible solutions:



2 shapes



3 shapes



4 shapes

Prerequisites:

Students should:

1. Understand the terms compare and contrast.
2. Understand the terms sides, angles, and vertices.

Geometric and Spatial Sense

What All Students “Should Do”

3 – 4

Written Benchmark: D

Connect geometric ideas to number and measurement ideas.

Problem 1:

Process Standard: 1.4, 2.7, and 3.4

Given a rectangle measuring 2 inches by 4 inches, ask students to measure the sides and find the perimeter in inches.



Solution Notes:

The perimeter is 12 inches.

The sides are 4 inches, 2 inches, 4 inches and 2 inches.

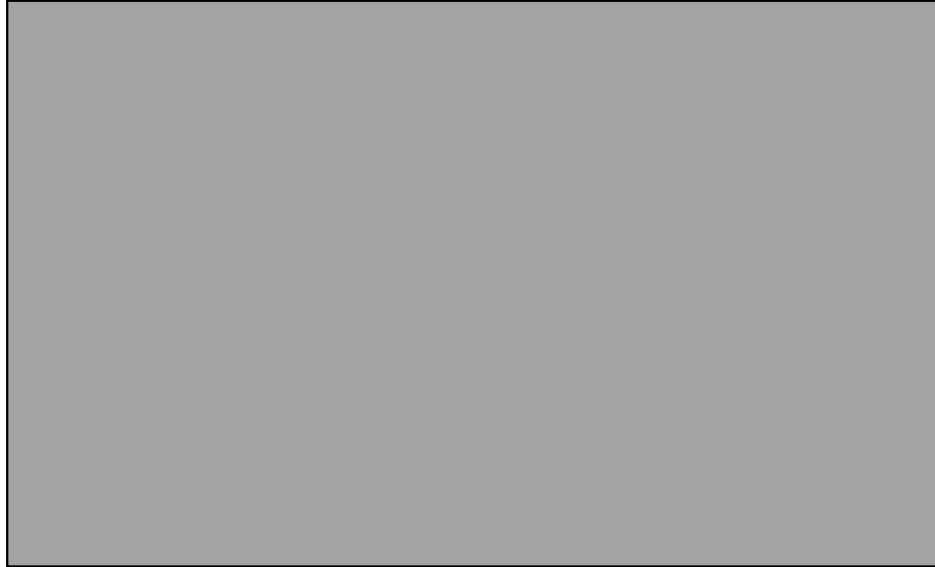
Prerequisites:

Students should:

1. Know how to use and read an inch ruler.
2. Understand the concept of perimeter.
3. Perform simple computation skills.

Problem 2:**Process Standards: 1.4, 2.7, and 3.4**

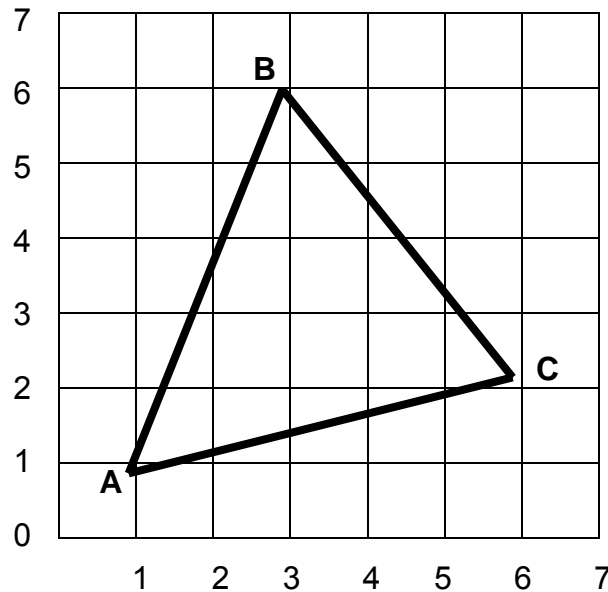
Given a rectangle measuring 3 inches by 5 inches, ask students to use color tiles to determine the area of the shape. Explain your solution.

**Solution Notes:**

The area is 15 square inches. Some children may need to cover the entire area with 15 color tiles. Others may notice that they can place 5 tiles along the top and 3 are needed down the side. If they are familiar with the use of arrays in multiplication, they may state that they could multiply 3×5 to find the total number of tiles needed.

Problem 3:**Process Standards: 3.3 and 1.8**

Given the coordinate graph below, ask students to identify each vertex of the triangle.



Extension: After identifying the vertices of the above triangle, students could list the vertices for drawing another triangle or another shape and share with a partner.

Solution Notes:

The vertices for the triangle should be listed as follows:

- A – (1,1)
- B – (3,6)
- C – (6,2)

Prerequisites:

Students should:

1. Know how to use a ruler measured off in inches.
2. Understand and apply knowledge and meaning of area.

Geometric and Spatial Sense

What All Students “Should Do”

3 – 4

Written Benchmark: E
Explore geometry in their world.

Problem 1:

Process Standards: 2.1, 2.2, 3.3, and 3.4

The teacher will begin by explaining to the students that this is a two-day project. Show and tell about the objective for the two days.

Objectives:

At the end of two class days, the students will:

1. Know the meaning of three-dimensional objects.
2. Identify and describe objects or models of the three-dimensional shapes (cylinder, cube, rectangular prism, cone, and sphere) using correct mathematical terms.
3. Design and construct three-dimensional models of real life objects that represent each of the shapes (cylinder, cube, rectangular prism, cone, and sphere).

First Day:

Ask the students if they have objects in their houses that are three-dimensional. Ask the students to bring to class one of each of the following:

- cylinder
- cube
- rectangular prism
- cone
- sphere

Second Day:

1. Have each student show his or her three-dimensional objects, tell the mathematical name of the three-dimensional object and explain why that is the correct mathematical name for the object.
2. Using paper, clay, rulers, scissors, and glue, have students construct a model for each of the 5 three-dimensional shapes the students brought to school. Students will label and describe each figure using correct mathematical terms.

Teacher's Notes:

All student descriptions should include correct mathematical terms (not just the basketball when talking about a sphere). Making the sphere out of paper would be difficult. Students might make the sphere out of clay or play dough.

Prerequisites:

Students should:

1. Know and identify 3-dimensional objects (cube, cylinder, cone, rectangular prism, and sphere).
2. Use correct mathematical terms for the objects.

Problem 2:

Process Standards: 4.6 and 3.5

Take an outside Shape Hunt. On the chart below sketch an object that corresponds to the shape named. Write an explanation on the chart telling why the object is the geometric shape named for that column.

Sphere	Cube	Prism	Cylinder	Cone

Solution Notes:

Possible solutions include objects found around the school, such as:

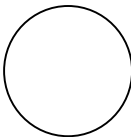
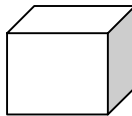
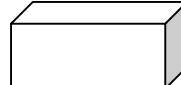
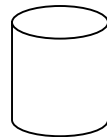

*Flagpole

*Doors

*Car wheels

*Basketball goal

*Signs

Sphere Basketball	Cube Sugar Cube	Prism Shoe Box	Cylinder Can of Soup	Cone Ice Cream Cone
				

Prerequisites:

Students should:

1. Know and identify 3-dimensional objects (cube, cylinder, cone, rectangular prism, and sphere).
2. Use correct mathematical terms in naming and describing objects.

Geometric and Spatial Sense

What All Students “Should Do”

3 – 4

Written Benchmark: F

Investigate concepts of lines, angles, similarity, congruence and symmetry.

Problem 1:

Process Standards: 1.6 and 2.5

Use pattern blocks to create a design that has at least one line of symmetry. Trace around the pattern blocks and draw the line(s) of symmetry. Explain in writing why the design is symmetrical.

Solution Notes:

The design should be divided into equal parts by the line(s) of symmetry. The explanation should show an understanding of symmetry that includes equal parts, divided the same, congruent, mirror image, etc.

Prerequisites:

Students should:

1. Identify a symmetrical design.
2. Understand and apply the definition of symmetry.

Problem 2:

Process Standards: 1.6, 1.8, and 3.1

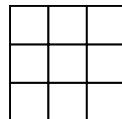
Use the square pattern blocks to build a series of similar squares. Record the number of sides in units for each similar square. For example: (1 x 1); (2 x 2), etc. Write an explanation telling how the figures are similar.



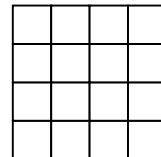
Square 1



Square 2



Square 3



Square 4

Solution Notes:

The charts are for teacher reference to determine the number of squares used to create

each similar square.

Square	Number of squares
1	1
2	4
3	9
4	16

Square	Number of Units in Sides
1	1
2	2
3	3
4	4

Students might state: "Each figure is similar because they are all squares. Just the length of the sides changed."

Prerequisites:

Students should:

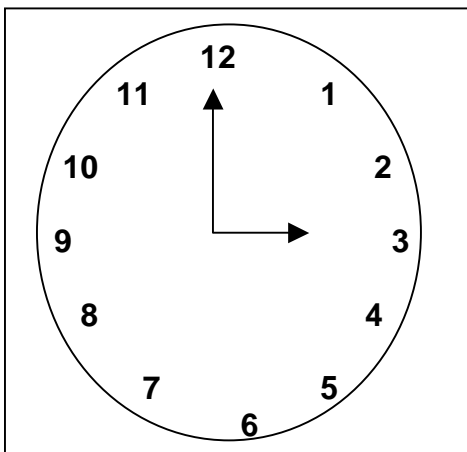
1. Understand and identify similar shapes.
2. Understand the term similarity.

Problem 3:

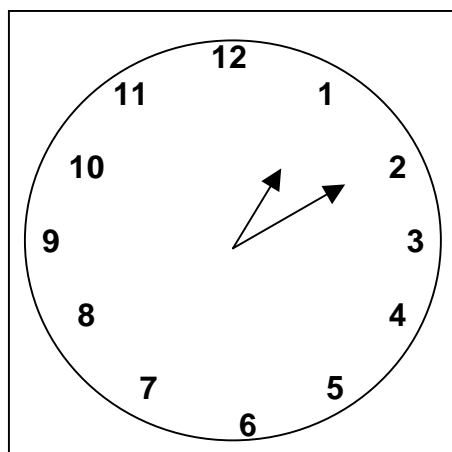
Process Standards: 2.7 and 3.5

Look at the clock faces. Describe and label the kinds of angles created by the hands on the clock.

A.

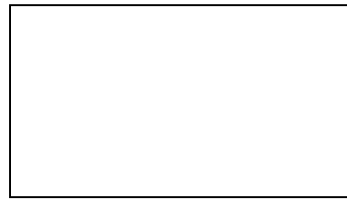
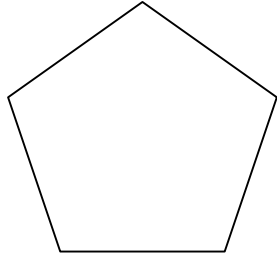


B.

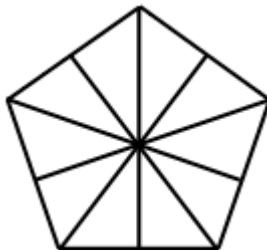
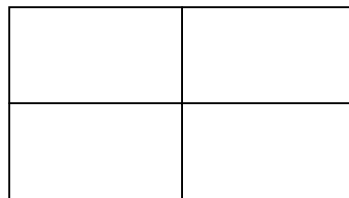


Solution Notes:

A is a right angle or a 90° angle. B is less than a right angle, or an acute angle.

Problem 4:**Process Standard: 3.3**

Given the drawings above or similar drawings, ask students to find and draw all lines of symmetry.

Solution Notes:**Prerequisites:**

Students should:

1. Know and identify the three types of angles by description and models (right angle, less than a right angle, greater than a right angle).

Geometric and Spatial Sense

What All Students “Should Do”

3 – 4

Written Benchmark: G

Investigate length, capacity, weight, mass, area, volume, time, and temperature.

Problem 1:

Process Standards: 3.3 and 3.6

Use 12 cubes to create various spatial models. What is the volume of each of the 3-dimensional shapes created? How do you know?

Solution Notes:

The students should recognize that no matter what the shape looks like, the volume would remain 12 cubic units (cubic inches if the length of each side of the cube is 1 inch, cubic centimeters if the length of each side is 1 centimeter, non-standard units may also be used). The type of manipulative will determine the unit of measure used for the activity.

Prerequisite:

Students should know:

1. The definition of volume.

Problem 2:

Process Standards: 1.6 and 3.6

If the value of a triangle pattern block has an area of 1, construct a design using pattern blocks that has an area of 19. Trace the pattern blocks within your design and label each block's shape with its value. Write an explanation that proves your design has an area of 19.

Solution Notes:

$\triangle = 1$ area, $\triangle \triangle = 2$ area and fits onto 1 blue rhombus, 1 blue rhombus = 2 area, hexagon = 6 area (6 \triangle 's fit onto 1 yellow hexagon) and trapezoid = 3 area (3 \triangle 's fit onto 1 trapezoid).

Prerequisites:

Students should:

1. Know the definition of area.
2. Have the experience of exploring with pattern blocks to understand the shape relationships between the small triangles and the other shapes.
3. Be able to perform simple calculations.

Problem 3:

Process Standards: 3.3, 3.1, and 3.5

It is 6:30 PM. Mark has 30 minutes of homework and he must practice the piano for 15 minutes. Will Mark be finished in time to watch his favorite T.V. show at 7:30 PM?

Write an explanation to share with the class.

Solution Notes:

Yes, Mark should finish at 7:15 PM, 15 minutes before the T.V. show begins.

Problem 4:

Process Standards: 1.4

Ask students to measure the length of the pencil from eraser to point. Record this measurement in inches and centimeters.

**Solution Notes:**

The length of the pencil is 3 ½ inches and 9 centimeters.

Geometric and Spatial Sense

What All Students “Should Do”

3 – 4

Written Benchmark: H

Use standard and non-standard units of measure.

Problem 1:

Process Standards: 1.2 and 1.4

Each group of students will need a 100 ml graduated cylinder, a 4-ounce cup, and a 1 ml eyedropper. Use the eyedropper to determine which container will hold the most drops of water. Students should predict which container would hold the most then compare the prediction with the true results after the measurements have been made with the eyedropper. The students should write a sentence comparing their prediction and their results, and tell why the two are or are not close to the same.

Solution Notes:

The students may choose the taller container as the largest because of its height. The 100 ml graduated cylinder and the 4-ounce cup will hold similar amounts of water. These results should lead to a discussion concerning the volume in relationship to the height of a container or that the tallest container does not always hold the most.

Prerequisites:

Students should:

1. Have experience using an eyedropper.
2. Know how to make predictions.
3. Have experience with the capacity of containers.

Problem 2:

Process Standards: 3.3 and 3.4

Design and construct a container without a lid that will hold three ping-pong balls. Use only one sheet of 8-½ inch by 11-inch copy paper. The paper may not be cut, but may be secured with tape or glue. Plan a design on paper, and explain the reasoning used in making the design. Construct the container and determine if it will hold three ping-pong balls by putting the ping-pong balls into the container.

Solution Notes:

Students will probably start with a cylinder and then progress to a rectangular prism. Some students may choose a triangular prism. All student responses should be

accepted if the reasoning justifies the design and the design uses only one sheet of paper that was not cut.

Prerequisite:

Students should:

1. Know, identify and apply the attributes of 3-dimensional shapes.
2. Visualize 3-dimensional figures.
3. Have estimation and prediction skills.

Geometric and Spatial Sense

What All Students “Should Do”

3 – 4

Written Benchmark: I

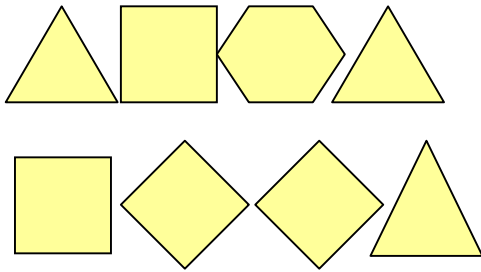
Locate objects by relative position including top, bottom, left, right, over, and under.

Problem 1:

Process Standards: 2.1, 2.2, and 3.2

Build two trains on parallel tracks with pattern blocks put end to end. Work in groups of two. Do not let the other student see your design. Give oral directions to the other person so they can build a train like yours. In the description use position words like left, right, top, bottom, between, below, above, etc.

Parallel Train Example:



Reverse the roles.

Solution Notes:

The students should be using words to describe relative position of the pattern blocks in the parallel trains. Words used may include:

- left
- top
- above
- right
- bottom
- below

The design should be parallel in order to aid in the development of position words like above and below.

Prerequisites:

Students should:

1. Know the meaning of the term parallel.
2. Know the meanings of the relative position terms.
3. Be able to give clear and concise oral directions.

Problem 2:**Process Standards: 1.7, 2.2, and 3.7**

Follow the clues below to place the 6 pattern blocks in the position.

- The six-sided figure is in the top row.
- The tan rhombus does not touch the six-sided figure.
- The 3-sided figure is above the tan rhombus.
- The trapezoid is below the blue rhombus.
- Place the square in the remaining box.

Extension:

Students could create their own set of clues for another person to follow.

Solution Notes:

Hexagon	Blue Rhombus	Triangle
Square	Trapezoid	Tan Rhombus

Or

Triangle	Blue Rhombus	Hexagon
Tan Rhombus	Trapezoid	Square

Prerequisites:

Students should:

1. Know and identify pattern block shapes by name and attributes.
2. Know and apply words describing relative position.
3. Interpret written and oral directions.
4. Write clear and concise directions.

DATA ANALYSIS, PROBABILITY AND STATISTICS

3 – 4

Data Analysis, Probability and Statistics

What All Students “Should Know”

3-4

1. Strategies to collect data.

Clarifications:

All students should know:

- How to participate and conduct limited surveys
- How to use various reference resources to collect data.
 - ◆Almanac ◆Atlas ◆Encyclopedia
 - ◆Newspaper ◆Maps ◆Timeline
 - ◆Internet
- How to read and interpret information from graphs, charts, and tables.

2. Strategies to organize data.

Clarifications:

All students should know how to organize data by:

- Sorting, categorizing, grouping
- Counting
- Tallying
- Making grids
- Comparing and contrasting using Venn diagrams
- Using graphic organizers
- Constructing and completing charts, lists, graphs, and tables

3. Different ways of displaying data.

Clarifications:

All students should know how to:

- Construct and interpret:
 - ◆Tables and charts ◆Pictographs
 - ◆Circle graphs ◆Line graphs
 - ◆Bar graphs
- Use software to construct graphs and charts.

4. The appropriate display of data.

Clarification:

- All students should know how to accurately choose and construct graphs, tables, or charts that appropriately represent collected data.

5. The appropriate use of technology.

Clarification:

All students should know how to:

- Use software to construct graphs.
- Locate data via the Internet or electronic media.
- Use the calculator in problem solving situations.

Data Analysis and Statistics

What All Students “Should Do”

3 – 4

Written Benchmark: A

Collect, organize, and describe data through the use of technologies and other resources.

Problem 1:

Process Standards: 1.4 and 1.8

Use resources available in the school to find the population of the capital cities of the states bordering Missouri. Organize the data in a useful form to compare the population of these cities. Describe the results.

Solution Notes:

Students can use reference resources including, but not limited to the almanac, atlas, encyclopedia, and Internet. The data could be organized in a variety of ways, but it must illustrate and compare the data collected accurately.

Prerequisites:

Students should:

1. Have knowledge of and know how to use reference resources.
2. Know how to use tables or graphs to organize material.

Problem 2:

Process Standards: 1.1 and 1.8

Choose a topic for an opinion survey (favorite TV show, pizza toppings, type of music, candy bars, etc.). Develop at least one question to ask class members. Use one of the methods you have learned to collect data. Organize and describe results of the survey. Include at least one comparison statement in the description of the results.

Solution Notes:

Questions should be clearly stated. Data collected should be accurately organized in a chart or table. Survey results should be described and the description must include one comparison statement.

Prerequisite:

Students should:

1. Know methods of collecting and organizing data.

Data Analysis and Statistics

What All Students “Should Do”

3 – 4

Written Benchmark: B

Construct, read, and interpret displays of data through verbal, nonverbal, symbolic, and graphic forms.

Problem 1:

Process Standard: 1.8

A class survey was conducted to determine the number of students who have birthdays each month. Construct a graph to display the information. Be sure to title and label your graph. Write at least 2 facts that can be determined from the data. The results of the survey are displayed below:

January	April	July	October
February	May	August	November
March	June	September	December

Solution Notes:

Graph accurately represents the data. Written facts accurately match the information displayed on the graph.

Sample Graph: The Number of Students’ Birthdays for Each Month of the Year

Months	January							
	February							
	March							
	April							
	May							
	June							
	July							
	August							
	September							
	October							
	November							
	December							
		1	2	3	4	5	6	7

Prerequisites:

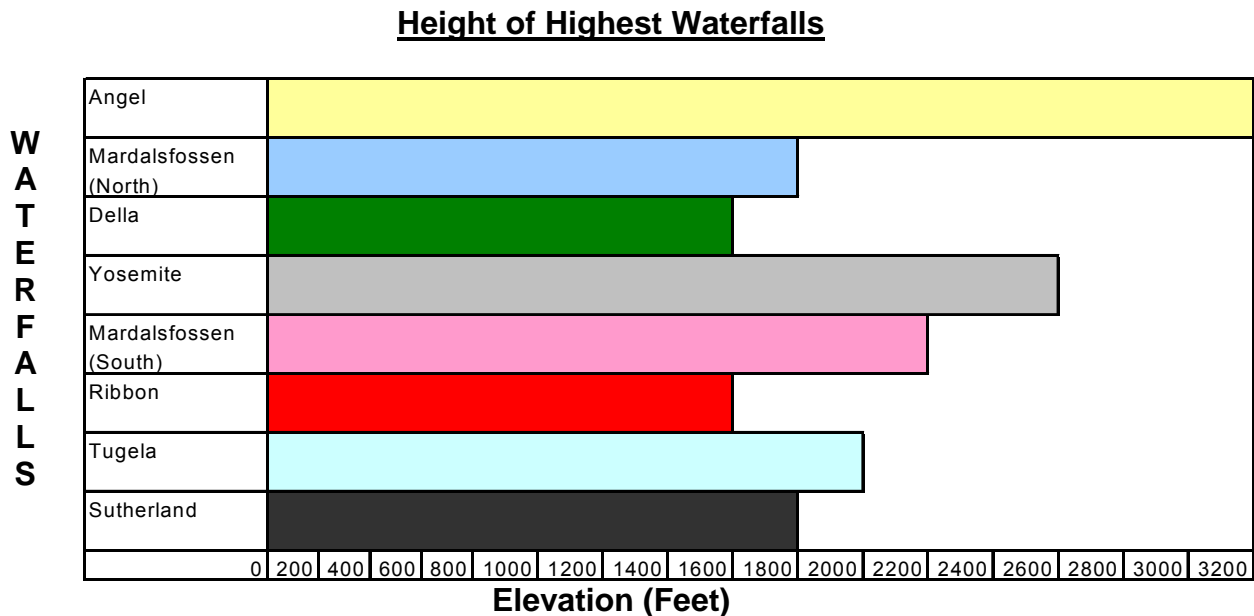
Number of Students

Students should know how to:

1. Construct graphs.

2. Graph data.

Problem 2:
Process Standard: 1.5



- A. Study the graph of the World's highest waterfalls. Use the information to design a table ranking the waterfalls from highest to lowest heights.
- B. Which two waterfalls have a combined height close to Angel Waterfall?
- C. What is the approximate difference in feet between the highest and lowest waterfall?
- D. What is the height difference in feet between Mardalsfossen (North) and Mardalsfossen (South)?

Solution Notes:

A.

Height in Feet	Waterfall
3200	Angel
2600	Yosemite
2200	Mardalsfossen (South)
2000	Tugela
1800	Sutherland
1800	Mardalsfossen (North)
1600	Ribbon
1600	Della

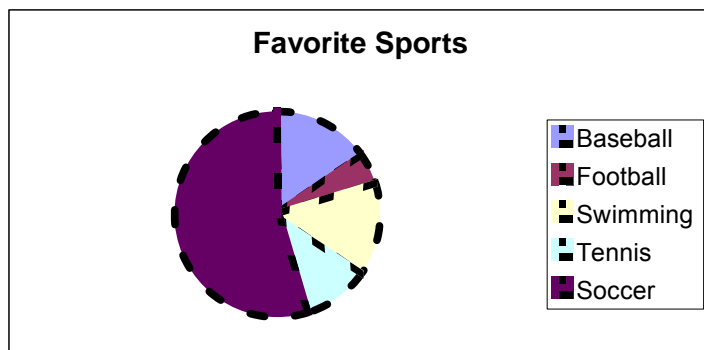
B. Della and Ribbon

C. Angel	3200 feet
Della	<u>1600 feet</u>
Difference	1600 feet

D. Mardalsfossen (North)	1800
Mardalsfossen (South)	<u>2200</u>
Difference	400

Problem 3:

Process Standard: 1.8



The graph above shows how many children participate in different sports.

Which sport do most children participate in?

Which sport do the least children participate in?

Write a statement that compares two sections of the graph.

Solution Notes:

Soccer was chosen the most, and football was chosen the least. Children might say more than 50%, or more than half, the children chose soccer with baseball and swimming showing equal numbers of participants.

Problem 4:

Process Standards: 1.8

Average Number of Flights Departing Morrow Airport

Sunday	✈ ✈ ✈
Monday	✈ ✈ ✈ ✈ ✈
Tuesday	✈ ✈ ✈ ✈
Wednesday	✈ ✈ ✈ ✈
Thursday	✈ ✈ ✈ ✈
Friday	✈ ✈ ✈ ✈ ✈
Saturday	✈ ✈

✈ Equal 10 departing flights from an airport

- How many flights departed on Tuesday?
- Which days are the busiest days at this airport?
- Why would this information be helpful to an airport manager?

Solution Notes:

Thirty-five flights depart on Tuesdays. Mondays and Fridays are the busiest days with 50 flights departing each of those days. Students might say an airport manager could use this information to help schedule employees. Accept any valid explanation.

Prerequisite:

Students should:

1. Know how to interpret graphs.

Data Analysis and Statistics

What All Students “Should Do”

3 – 4

Written Benchmark: C

Solve problems that require collecting and analyzing data.

Problem 1:

Process Standards: 1.2 and 3.3

The school cook needs help from some students. The cafeteria serves white and chocolate milk at lunch. The cook needs to determine how many cartons of each kind to order each week. Develop a plan to help the cook solve the problem.

Solution Notes:

The plan may include conducting a survey, tabulating the types of milk actually chosen by students at each lunch period or tabulating one lunch period and making a generalization.

Extension:

Students may execute their plans, gather and analyze data, then make a recommendation based on the data for ordering milk. Write a letter to the cook explaining the plan and the results.

Prerequisite:

Students should know:

1. How to develop strategies for solving problems.

Problem 2:

Process Standards: 1.5 and 4.1

Wilt Waterson and Michael Moses are the two best scoring players in the history of Williamsburg High School basketball. Use the information in the tables below to predict which of the two players will be chosen Best All Time Scoring Leader. Be sure to show all work and explain your reasoning. Use mathematics to support your conclusion.

Wilt Waterson			Michael Moses		
Year	Points Scored	Average	Year	Points Scored	Average
1966	477	19.1	1997	420	16.8
1967	505	20.2	1998	605	24.2
1968	562	22.5	1999	560	22.4

Solution Notes:

Michael Moses has the greatest number of points scored and the highest average for three years. Students might also say Wilt Waterson had the largest average for two years. Accept any valid answer.

Prerequisites:

Students should:

1. Know how to analyze data.
2. Know how to determine the average of a set of numbers.

Data Analysis and Statistics

What All Students “Should Do”

3 – 4

Written Benchmark: D
Explore concepts of chance.

Problem 1:

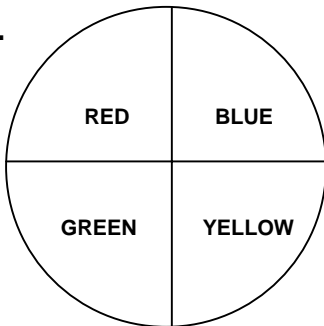
Process Standards: 1.6 and 3.3

- A. Design a spinner of four colors (red, green, blue, and yellow) so that the probability of the spinner landing on each color is the same.
- B. Design a second spinner of four colors (red, green, blue, and yellow) so that the probability of the spinner landing on green is the greatest.
- C. Design a spinner so that the probability of landing on green is $\frac{3}{8}$, blue is $\frac{1}{2}$ and red is $\frac{1}{8}$.

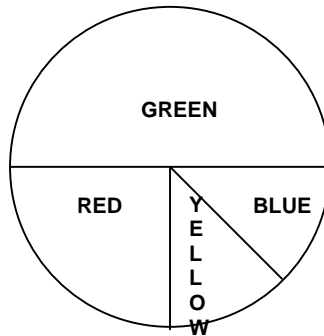
Solution Notes:

Examples of Possible Answers—

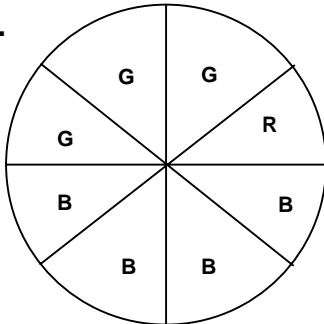
A.



B.



C.



**G-Green
R-Red
B-Blue
Y-Yellow**

Prerequisite:

Students should:

1. Know how to use ratio in problem solving situations.

Problem 2:**Process Standards: 1.6 and 4.1**

A student is given a number cube to roll 20 times. Predict the number of times an even number will be rolled and the number of times an odd number will be rolled. Roll the cube 20 times and record the results. Were the predictions correct? If the experiment is repeated will the results be similar? Explain the answer.

Solution Notes:

If students understand the concept of probability, the predictions should indicate an equal number of odd numbers and even numbers for the 20 tosses of the cube. Student responses about repeating the experiment may vary, but they all should indicate an understanding of probability.

Prerequisite:

Students should:

1. Have a working knowledge of probability.

Problem 3:**Process Standard: 1.6**

Give a student a bag with 4 red marbles, 6 blue marbles, 3 green marbles, and 5 yellow marbles. Ask the student to pull one marble out of the bag, without looking. What is the probability the student will take out:

- | | |
|--------------------|--------------------------|
| A. A red marble? | D. A yellow marble? |
| B. A blue marble? | E. A white marble? |
| C. A green marble? | F. A red or blue marble? |

Solution Notes:

- | | |
|--|----------------------------------|
| A. 4 out of 18 or $\frac{2}{9}$ | D. 5 out of 18 |
| B. 6 out of 18 or $\frac{3}{9}$, $\frac{2}{6}$, or $\frac{1}{3}$ | E. 0 out of 18 |
| C. 3 out of 18 or $\frac{1}{6}$ | F. 10 out of 18 or $\frac{5}{9}$ |

Prerequisite:

Students should:

1. Have a working knowledge of probability.

PATTERNS AND RELATIONSHIPS

3 –4

Patterns and Relationships

What All Students “Should Know”

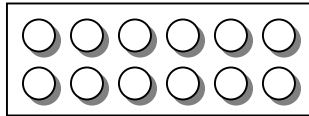
3 – 4

1. Mathematical ideas may be represented with visual models.

Clarifications:

All students should know:

- Visual models help students identify the structure of a pattern and describe it symbolically.
 - ♦ Place value chart
 - ♦ Hundreds chart
- Arrays show multiplication (repeated addition) and area, as well as division.
- Isometric dot paper may be used to draw three-dimensional figures.
- Visual models may be used to show real-life objects.



10¢

Dime



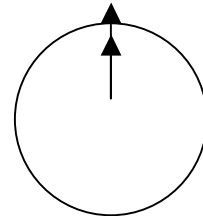
1¢

Penny



1¢

Penny



12 = 2 six packs, 12 = one dozen eggs, 12 = dime and two pennies, 12 = 12 o'clock

- Manipulatives help develop number concepts.
 - ♦Counters ♦Attribute blocks ♦Fraction models ♦Pattern blocks

2. Mathematical symbols can be used to represent real-world situations.

Clarifications:

All students should:

- Use mathematical properties (commutative, associative, distributive, etc.) to compute mentally and look for patterns to help solve problems.
- Use math symbols to show patterns of change (change over time, rate of change, etc.) such as plant growth, temperature, and number of daylight hours.
- Know how to generalize patterns or information to make predictions or write equations.
- Use inequalities to make comparisons.

3. Patterns and relationships can be represented in a variety of ways.

Clarifications:

All students should:

- Sort and classify objects/numbers.
- Identify sorting rules.
- Order and/or correctly sequence objects and numbers.
- Represent the same pattern in a variety of ways:
 - ◆Verbally ◆Musically
 - ◆Concretely ◆Pictorially

4. Information can be organized to look for a pattern or relationship.

Clarifications:

All students should:

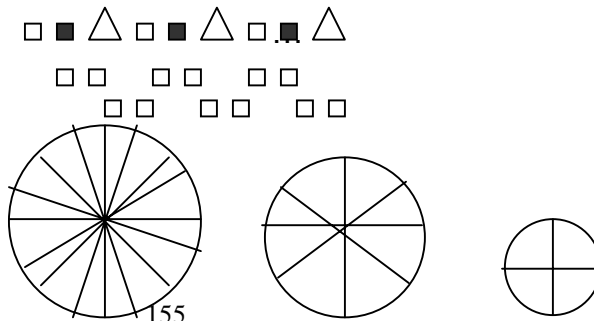
- Put information into a chart, table, and organized list to look for a pattern or relationship or to solve a problem.
- Put information into a graph to recognize a pattern or solve a problem.
 - ◆Pictographs ◆Bar graphs ◆Coordinate graphs ◆Line graphs ◆Circle graphs
- Use a function machine for input/output charts.
- Use computer spreadsheets to organize information to produce a graph.
- Use a hundreds chart to show patterns and relationships in the natural number system.
- Use graphic organizers.

5. Patterns can be geometric and/or numeric.

Clarifications:

All students should know:

- Numeric patterns:
 - ◆Repeated patterns: 123, 123, 123...
 - ◆Growing patterns: 1, 1, 2, 3, 5, 8, 13 ... (Fibonacci)
 - ◆Shrinking patterns: 40, 36, 32, 28, 24...
- Geometric patterns:
 - ◆Repeated patterns:
 - ◆Positional patterns:
 - ◆Shrinking patterns



◆Growing patterns:



◆ Tessellations

◆Patterns in real life objects: clothes, classroom, architecture

◆Patterns of rotational symmetry: C_{2v}

- Identify, describe, extend, and create patterns mentally, with pencil and paper, using a calculator, computer, or manipulative.

Patterns and Relationships

What All Students “Should Do”

3 – 4

Written Benchmark: A

Create, recognize, describe, and extend a wide variety of patterns.

Problem 1:

Process Standards: 1.6 and 3.5

Leonardo Fibonacci, an Italian Mathematician, found this pattern: 1, 1, 2, 3, 5, 8, 13, ...

What number comes next in the sequence? Explain the approach used in determining the number.

Solution Notes:

21, the new number in the sequence is found by adding the two prior numbers together, so $8 + 13 = 21$.

Problem 2:

Process Standards: 1.6 and 3.5

Listed below are four number patterns. Which two number patterns have the same relationship, or use the same rule to determine the next number in the sequence?

- A. 1, 3, 5, 7, 9...
- B. 2, 5, 8, 11, 14...
- C. 9, 11, 13, 15, 17...
- D. 11, 13, 16, 20, 25...

Name the rule that the two patterns share.

Solution Notes:

A and C

In both sequences A and C, the next number in the sequence is found by adding two to the previous number in the sequence. Both sequences A and C are sequential odd numbers.

Problem 3:**Process Standards: 1.6 and 2.1**

Create 4 examples of an A B B A B B A pattern and write the patterns on the lines below. Be sure to include 7 items in each pattern. In one of the 4 patterns, write the last (seventh) term incorrectly on purpose. After the patterns are finished, students will exchange papers with another student, then try to find each other's mistake. The patterns may contain numbers, pictures, shapes, etc.

Example: 

1. _____
2. _____
3. _____
4. _____

Line _____ has a mistake in the last term.

Solution Notes:

Answers will vary. On one of the 4 lines, the last term must be incorrect. It must match what the student identified as the mistake.

Problem 4:**Process Standards: 1.6 and 1.8**

Jose has a book with 20 chapters. If he reads one chapter per day during the week and 2 chapters each on Saturday and Sunday, on what day will he finish the book? Show how the problem can be solved. He will begin to read on Monday.

Solution Notes:

Jose will finish the book on Tuesday.

S	0	2	2
M	1	1	1
T	1	1	1
W	1	1	
T	1	1	
F	1	1	
S	2	2	
Totals	7	+ 9	+ 4 = 20

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	1	1	1	1	2
2	1	1	1	1	1	2
2	1	1				

Problem 5:**Process Standards: 1.6 and 3.5**

Study the pattern in the input/output table below. Find the rule and complete the table.
Write a number sentence to describe the rule.

Input	2	6	7	9	12
Output	5	13	15		

Solution Notes:

Input	2	6	7	9	12
Output	5	13	15	19	25

Students may write a number sentence as:
 $(\text{Input} \times 2) + 1 = \text{Output}$ or $(n \times 2) + 1 = \text{Output}$.

Patterns and Relationships

What All Students “Should Do”

3 – 4

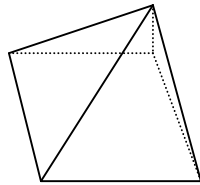
Written Benchmark: B

Represent and describe mathematical relationships.

Problem 1:

Process Standards: 1.6

Pyramids have a flat base (bottom) and flat faces that come to a point on top. Here is a picture of a square pyramid.



The picture above is of a square pyramid:

- ◆ It has a square base.
- ◆ It has 5 faces (1 square and 4 triangles).
- ◆ It has 5 vertices (corners).

Fill in the chart below with the correct numbers for the pyramids listed.

Number of Faces			
Number of Vertices			
Shape of Base	Triangle	Square	Hexagon

What is the relationship between the number of faces and the number of vertices of these pyramids? What is the relationship between the base and the number of faces?

Solution Notes:

4	5	7
4	5	7

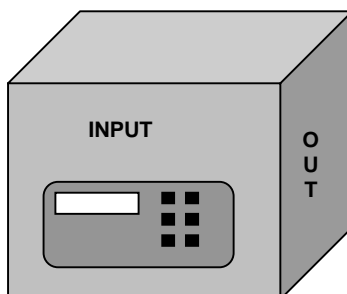
For a pyramid, the number of faces is equal to the number of vertices. For a pyramid, the number of faces is one more than the number of sides on the base.

Problem 2:

Process Standards: 1.6, 3.2, and 3.5

With a function machine, a number enters the machine (input), a rule is applied to the number, and an answer comes out (output). For the function machine at the right, the list of input/output numbers are:

INPUT	OUTPUT
1	4
2	8
3	12
4	16



What is the rule that is applied to the input to get the output?

Create your own input/output chart for a new function machine with the following rule: multiply by two then add one.

Solution Notes:

The input number is multiplied by 4.

Any input/output chart with correct numbers such as:

INPUT	OUTPUT
1	3
2	5
5	11

Patterns and Relationships
What All Students “Should Do”
3 – 4

Written Benchmark: C

Investigate the use of variables and open sentences in expressing relationships.

Problem 1:

Process Standards: 1.6, 2.1, and 3.5

Fill in the missing number in each equation:

A. $4 \times \square = 20$

B. $6 \times 3 = 3 \times \square$

C. $\square \times 4 \times 2 = 12 \times 2$

Explain how the missing number for equation C was determined.

Solution Notes:

A. 5

B. 6

C. 3

A student may say, “I know that $12 \times 2 = 24$. $4 \times 2 = 8$, so $8 \times 3 = 24$. The missing number is 3.” Accept any answer that reflects correct thinking.

Problem 2:

Process Standards: 2.1 and 3.5

Write a story problem for this equation:

$$(2 \times \$4.98) + \$7.49 = \square$$

Make sure the story problem ends in a question. Make sure the story problem fits the equation. When the story problem is completed, solve the equation. Show the work and the solution.

Solution Notes:

Accept any problem that fits the equation. Possible solution:

J. J. bought 2 beanie babies for \$4.98 each. She also bought a pair of earrings for \$7.49. How much money did she spend?

$$2 \times \$4.98 = \$9.96 \quad \$9.96 + 7.49 = \$17.45 \quad \text{J. J. spent } \$17.45.$$

MATHEMATICAL SYSTEMS AND NUMBER THEORY

3 – 4

Mathematical Systems and Number Theory

What All Students “Should Know”

3 – 4

1. Basic operations of addition, subtraction, multiplication, and division are related to each other.

Clarifications:

All students should know:

- Fact families help explain inverse relationships.
 - ♦ $2 + 3 = 5$ $5 - 2 = 3$
 $3 + 2 = 5$ $5 - 3 = 2$
 - ♦ $5 \times 6 = 30$ $30 \div 6 = 5$
 $6 \times 5 = 30$ $30 \div 5 = 6$
- The commutative property for addition and multiplication.
 - ♦ $(a + b) = (b + a)$
 - ♦ $(a \times b) = (b \times a)$
- Associative property.
 - ♦ $a + (b + c) = (a + b) + c$
 - ♦ $a \times (b \times c) = (a \times b) \times c$
- Distributive property.
 - ♦ $a \times (b + c) = (a \times b) + (a \times c)$
- Addition and subtraction are inverse relationships.
- Multiplication and division are inverse relationships.
- Multiplication is a form of repeated addition.
- Division is a form of repeated subtraction.
- Addition can be used to check a subtraction problem.
- Multiplication can be used to check a division problem.
- The distributive properties can be used to solve larger multiplication problems.
 - ♦ $(14 \times 6) = (10 \times 6) + (4 \times 6)$

2. The concepts of factors and multiples in relation to multiplication and division.

Clarifications:

All students should know:

- Skip counting is a way of listing multiples.
 - A factor is a divisor of a number.
 - ♦ Example: 12 4 4 is a factor of 12
 - A factor is a whole number that divides evenly into another.
- Some numbers have only two factors (prime).

- Some numbers have more than two factors (composite).
- Some numbers have common factors.
 - ♦ Example: The factors of 6 are: 1, 2, 3, and 6.
 The factors of 12 are: 1, 2, 3, 4, 6, and 12.
 The common factors are: 1, 2, 3, and 6.
- Using factors and multiples help determine equivalent fractions and the simplest form of a fraction.
 - ♦ Example: $\frac{6}{8} \div \frac{2}{2} = \frac{3}{4}$ 2 is a factor of both 6 and 8.
 $8 \div 2 = 4$
- A multiple of any number is the product of that number and another whole number.
 - ♦ Example: multiples of three $3 \times 1 = 3$ $3 \times 2 = 6$ $3 \times 3 = 9$
- Some numbers have common multiples.
 - ♦ 6: 6, 12, 18, 24 The common multiples are 12, 24, ...
 - ♦ 12: 12, 24
- Divisibility rules help us understand multiplication and division relationships. A number is divisible by another number if there is no remainder.
- When multiplying two even factors or an even and an odd factor, the product is always even. When multiplying two odd factors, the product is always odd.
- A number other than one is a prime number if its only factors are itself and one.

Mathematical Systems and Number Theory

What All Students “Should Do”

3 – 4

Written Benchmark: A

Develop the need for whole numbers, integers and rational numbers, including fractions and decimals by looking for patterns and relationships to solve problems.

Problem 1:

Process Standards: 1.6, 3.2, and 3.3

The fourth grade class had a pizza party for reading the most books in the school. Eight pizzas were delivered and each was cut into 6 equal slices. When they were finished eating, $2\frac{1}{2}$ pizzas were left. How many slices were left? Show how you solved the problem.

Solution Notes

Pizzas Left



Many fourth grade students would solve the problem by drawing a picture.

Fifteen slices are left.

Prerequisites:

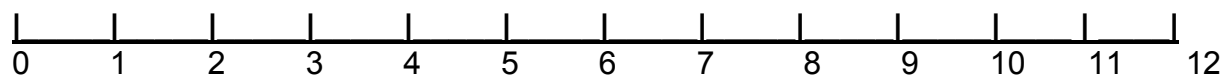
Students should:

1. Have knowledge of fractional parts.

Problem 2:

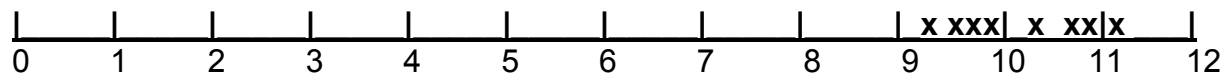
Process Standards: 1.6 and 1.8

The fourth grade students are growing plants for a science project. Each group is supposed to record the height of their plant on the number line. Use the data below to record on the number line.



Group 1 10.2 cm
 Group 2 11.1 cm
 Group 3 10.8 cm
 Group 4 9.2 cm
 Group 5 9.7 cm
 Group 6 9.6 cm
 Group 7 10.9 cm
 Group 8 9.9 cm

Solution Notes:



Mathematical Systems and Number Theory

What All Students “Should Do”

3 – 4

Written Benchmark: B

Develop and use number operations and order relations for decimals (money).

Problem 1:

Process Standards: 1.6 and 3.3

Use catalogs to choose clothes and supplies to order for summer camp. A camper is limited to a budget of \$100.00. Make a list of the items to purchase, including how much each item will cost. No more than \$5.00 of the money should be left.

Solution Notes:

The answers will vary depending on students' choices. All of the criteria from the problem should be followed and computation completed correctly.

Problem 2:

Process Standards: 1.6 and 3.3

Use coins and/or bills to show at least four possible ways to make \$9.23.

Solution Notes:

Answers will vary. The total amount of the coins and/or bills listed must equal \$9.23.

Problem 3:

Process Standards: 1.6 and 3.3

Some 4th graders sold erasers for their school store. Jane sold \$2.15, Bob sold \$1.16, Alecia sold \$2.00, Julie sold \$2.95, Deon sold \$1.29, and Clayton sold \$2.91 worth of erasers. Arrange their sales in order from least to greatest amount of money. Name the 4th graders who sold between \$2.00 and \$3.00.

Solution Notes:

Sales of each student arranged in order from least to greatest amount of sales. (\$1.16, \$1.29, \$2.00, \$2.15, \$2.91, \$2.95). Students having sales between \$2.00 and \$3.00. (Jane \$2.15, Julie \$2.95, and Clayton \$2.91).

Mathematical Systems and Number Theory

What All Students “Should Do”

3 – 4

Written Benchmark: C

Develop an understanding of how basic arithmetic operations are related to one another.

Problem 1:

Process Standards: 1.6 and 3.6

Provide students with six small paper plates, several counters and a number cube. Have students roll the cube to determine how many plates to set out. Students roll the cube again and place that number of counters on each plate. Have the students write one addition and one multiplication equation illustrated by the manipulative.

Example: First roll is a 2, students set out 2 paper plates. Second roll is a 3, then the students place 3 counters on each plate.

Student writes: $2 \times 3 = 6$
 $3 + 3 = 6$



Solution Notes:

Solutions will vary according to the numbers rolled by the students.

Prerequisites:

Students should:

1. Know basic addition facts.
2. Have a basic understanding of sets.

Problem 2:

Process Standards: 1.6 and 3.3

Use an understanding of the inverse relationship between addition and subtraction to solve the problems below. Write the missing numbers in the boxes.

1.)
$$\begin{array}{r} 262 \\ - \square\square\square \\ \hline \square45 \end{array}$$

2.)
$$\begin{array}{r} 3\square4 \\ - \square5\square \\ \hline 167 \end{array}$$

3.)
$$\begin{array}{r} \square1\square \\ - 33 \\ \hline 83 \end{array}$$

$$\begin{array}{r}
 4.) \quad \underline{25} \\
 \square) 125 \\
 - \underline{\square 0} \\
 \square \square \\
 \underline{2 \square} \\
 0
 \end{array}$$

$$\begin{array}{r}
 5.) \quad \underline{\square \square \square} \\
 3) \square 2 \square \\
 - \underline{6} \\
 02 \\
 \underline{\square} \\
 \square 1 \\
 \underline{\square \square} \\
 0
 \end{array}$$

$$\begin{array}{r}
 6.) \quad \underline{5 \square R \square} \\
 8) \square 06 \\
 - \underline{4 \square} \\
 0 \square \\
 - \underline{0} \\
 6
 \end{array}$$

Solution Notes:

$$\begin{array}{r}
 1. \quad 262 \\
 - 17 \\
 \hline
 245
 \end{array}$$

$$\begin{array}{r}
 2. \quad 324 \\
 - 157 \\
 \hline
 167
 \end{array}$$

$$\begin{array}{r}
 3. \quad 116 \\
 - 33 \\
 \hline
 83
 \end{array}$$

$$\begin{array}{r}
 4. \quad \underline{25} \\
 5) 125 \\
 - \underline{10} \\
 25 \\
 - \underline{25} \\
 0
 \end{array}$$

$$\begin{array}{r}
 5. \quad \underline{207} \\
 3) 621 \\
 - \underline{6} \\
 02 \\
 - \underline{0} \\
 21 \\
 - \underline{21} \\
 0
 \end{array}$$

$$\begin{array}{r}
 6. \quad \underline{50R6} \\
 8) 406 \\
 - \underline{40} \\
 06 \\
 - \underline{0} \\
 6
 \end{array}$$

Prerequisites:

Students should know the:

1. Basic addition and subtraction facts.
2. Basic multiplication facts.
3. Long division algorithm.

Mathematical Systems and Number Theory

What All Students “Should Do”

3 – 4

Written Benchmark: D

Develop and use number theory concepts, including factors and multiples in problem solving.

Problem1:

Process of Standards: 1.6 and 3.3

Louise has a small pond in her backyard. There are eight animals (ducks, turtles, and fish) in the pond with a total of 16 eyes and 24 feet. If the pond contains at least 1 of each kind of water animal, how many ducks, turtles, and fish are in Louise’s pond? Show how you solved the problem.

Response Box

Solution Notes:

Correct Solution – 5 turtles, 2 ducks, 1 fish. Possible Method:

	1	2	3	4	5	6	7	8
• • = eyes	• •	• •	• •	• •	• •	• •	• •	• •
^ ^ = 2 legs	^ ^	^ ^	^ ^	^ ^	^ ^	^	^	0 legs
	Turtle	Turtle	Turtle	Turtle	Turtle	Duck	Duck	Fish

Prerequisites:

Students should know:

1. Turtles have 4 legs, ducks have 2 legs and fish do not have legs.
2. Addition combinations with a sum of 24.

Problem 2:**Process Standards: 1.6 and 3.5**

Jacob wants to bring treats to his class on his birthday. His class has 28 students which includes Jacob. He wants to give each classmate 1 snack cake and 1 candy bar. He wants to treat the teacher too. A box of cakes has 8 individually wrapped packages of two cakes each. Candy bars come in a package of 6. How many boxes of the cakes and how many packages of candy bars must he buy?

Solution Notes:

<u>Cakes</u>		<u>Candy Bars</u>	
1 box	16	1 package	6
2 boxes	32	2 packages	12
		3 packages	18
		4 packages	24
		5 packages	30

Jacob will need 2 boxes of cakes and 5 packages of candy bars.

Prerequisite:

Students should:

1. Know basic multiplication facts or how to skip count.

Problem 3:**Process Standards: 1.6 and 3.5**

I'm thinking of a number that is greater than 20 and less than 40. My number is even. My number is a multiple of 7. What is the number I am thinking of?

Solution Notes:

28 fit all the clues given above. It may be helpful to some children to list the even numbers between 20 and 40, then eliminate numbers to meet the next clue.

Mathematical Systems and Number Theory

What All Students “Should Do”

3 – 4

Written Benchmark: E

Model, develop, and explain basic facts and algorithms with reasonable proficiency.

Problem 1:

Process Standards: 3.6

Use grid paper to cut out arrays that represent multiplication facts with a product of 36. Write the multiplication facts that are represented by each array.

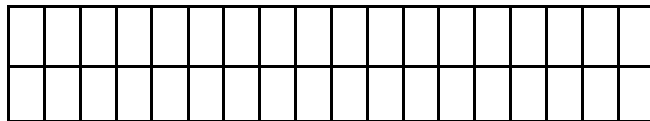
Solution Notes:

Students should cut rectangles of 36×1 , 18×2 , 12×3 , 9×4 , and 6×6 from grid paper.

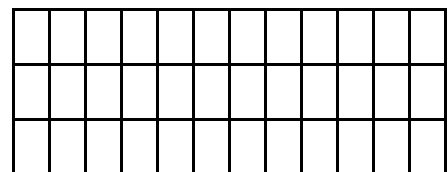
$$36 \times 1 = 36$$



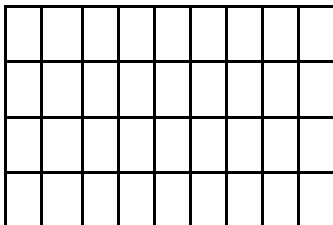
$$18 \times 2 = 36$$



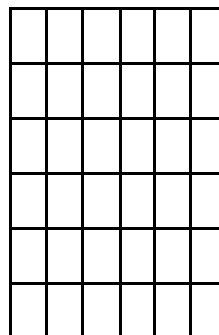
$$12 \times 3 = 36$$



$$9 \times 4 = 36$$



$$6 \times 6 = 36$$



Prerequisite:

Students should:

1. Understand the meaning of multiplication.

DISCRETE MATHEMATICS

3 – 4

Discrete Mathematics

Discrete Mathematics can be more easily interpreted by thinking in five categories:

- Networks and Pathways
- Counting - combinations / permutations
- Fair Division
- Logic and Reasoning
- Matrices

The clarifications for the knowledge statements are related to these five categories.

Discrete Mathematics

What All Students “Should Know”

3 – 4

1. Numbers in sequence to count objects.

Clarifications:

All students should know:

- Ordinal numbers (1st, 2nd, 3rd)
- Skip counting
- Number arrangements to equal the sum of parts
 - ♦ Combinations of numbers to create algorithms
 - ♦ Venn diagrams
 - ♦ Organizing information into arrays

2. Definition of “more” and “fewer”.

Clarification:

All students should know:

- Methods of comparison for two quantities to determine which has more or fewer.

3. Definition of “same” and “different”.

Clarifications:

All students should know:

- Methods for categorizing objects by 1 - 5 attributes:
 - ♦ Physical characteristics
 - ♦ Size and orientation - flip, rotation, symmetry, slide, similar
- Methods of comparison:
 - ♦ Physical characteristics
 - ♦ Size and orientation - flip, rotation, symmetry, slide, congruent, similar
- Methods for sorting:
 - ♦ Physical characteristics
 - ♦ Size and orientation - flip, rotation, symmetry, slide, congruent, similar

4. Definition of “shortest” and “longest”.

Clarifications:

All students should know how to:

- Compare and sort objects by length.
- Order objects by length.

Discrete Mathematics
What All Students “Should Do”
3 – 4

Written Benchmark: A

Determine what should be counted in a set of objects and actually count the objects.

Problem 1:

Process Standards: 1.8 and 3.5

Sam, Mary, and Ann are sitting in a row. Each day they get to move their desks. How many different ways can they arrange their desks so that everyone gets to take a turn being in the front of the room and everyone takes a turn being in the back of the room? Explain your answer using pictures, numbers and a sentence.

Solution Notes:

S	S	M	M	A	A
M	A	A	S	S	M
A	M	S	A	M	S

You can arrange the desks in 6 different ways.

Problem 2:

Process Standards: 1.6 and 2.1

Bill is planting tulip bulbs for his grandparents. He has 16 tulip bulbs. How many different ways can he arrange the bulbs in a rectangular shaped garden? Show all possible arrangements.

Solution Notes:

1 X 16

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2 X 8

4 X 4

Discrete Mathematics
What All Students “Should Do”
3 – 4

Written Benchmark: B

Predict whether the set contains more or fewer of one subset than the other.

Problem 1:

Process Standard: 3.3

You have been given a bag of lima beans and a bag of navy beans. Each bag is the same size and the weight of the beans is the same. Which bag do you think will have more beans? Write a sentence to explain your answer.

Solution Notes:

The children should realize that there would be more navy beans because the navy beans are smaller and more could fit in the bag. The students should notice the bags are the same size.

Problem 2:

Process Standards: 1.6 and 3.5

A school has 12 children trying out for the basketball team, 5 girls and 7 boys. First the team will have a practice game. The coach will divide the children into two teams. The coach will first select a boy for each team, then a girl for each team. Which team will have more girls if the coach begins with the A team?

A Team **B Team**

Explain your answer.

Solution Notes:

The A Team will have 3 girls and The B Team will have only 2 girls.

A Team

B
G
B
G
B
G
B

B Team

B
G
B
G
B

Prerequisites:

Students should:

1. Review sorting.
2. Review division of groups.

Discrete Mathematics

What All Students “Should Do”

3 – 4

Written Benchmark: B

Illustrate or explain how the subsets of objects are the same or different.

Problem 1:

Process Standards: 1.6 and 4.1

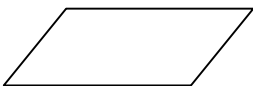

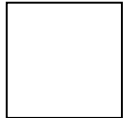

The teacher selects students to come to the front of the room to stand with one of the two groups of students in a location predetermined by 3 attributes selected by the teacher. For example the first group has the attributes of short hair, t-shirts, and sandals. The second group has the attributes of long hair, button shirts, and tennis shoes. The children not selected to be in-group 1 or group 2, are asked what attributes (characteristics) are used to group the children. The children in the groups are encouraged to also identify the attributes of the two groups.

Solution Notes:

The sorting attributes will vary according to students’ level of experience and ability.

Problem 2:

Process Standards: 1.6 and 4.1

			
A	B	C	D

1. Given the set of quadrilaterals above, which figures would be in the subset of quadrilaterals with at least one right angle?
2. Given the set of quadrilaterals above, choose two or more figures to form a subset, and write a sentence to describe a rule for their selection.

Solution Notes:

Figures B and C both have at least one right angle.

Accept any valid rule for creating a subset. Possible answers may include:

1. Figure A and D have no right angles. 2. Figure A and D have 2 acute and 2 obtuse angles. 3. Figure A and B have two sets of parallel lines with one short set and one longer set.

Problem 3:**Process Standards: 1.6 and 4.1**

At Charlie's Deli, you can build your own sandwich. You can choose roast beef or turkey, American or Swiss cheese, and white or wheat bread. Each sandwich must have one kind of bread, one meat and one cheese. Find all the possible combinations of sandwiches.

Solution Notes:

There are 8 combinations possible. Students might find it helpful to make an organized list.

- Roast beef, American, white
- Roast beef, Swiss, white
- Roast beef, American, wheat
- Roast beef, Swiss, wheat

- Turkey, American, white
- Turkey, Swiss, white
- Turkey, American, wheat
- Turkey, Swiss, wheat

Discrete Mathematics

What All Students “Should Do”

3 – 4

Written Benchmark: D

Identify and discuss overlapping subsets of objects (Venn diagrams).

Problem 1:

Process Standards: 1.2 and 1.8

Conduct a survey in your class to determine how many children wore T-shirts or tennis shoes or both or neither. Use data to construct a Venn diagram using correct labels.

Discuss the Venn diagram:

How many children wore tennis shoes?

How many children wore T-shirts?

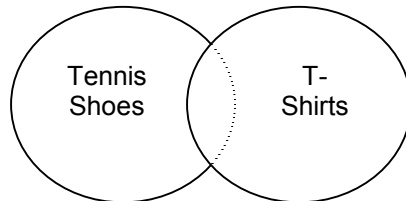
How many children wore both tennis shoes and T-shirts?

How many children wore neither tennis shoes nor T-shirts?

Solution notes:

Students will collect data from a class survey and appropriately place the data on the diagram.

Who wore T-shirts and or tennis shoes today?



Accept appropriate responses to discussion questions.

Prerequisite:

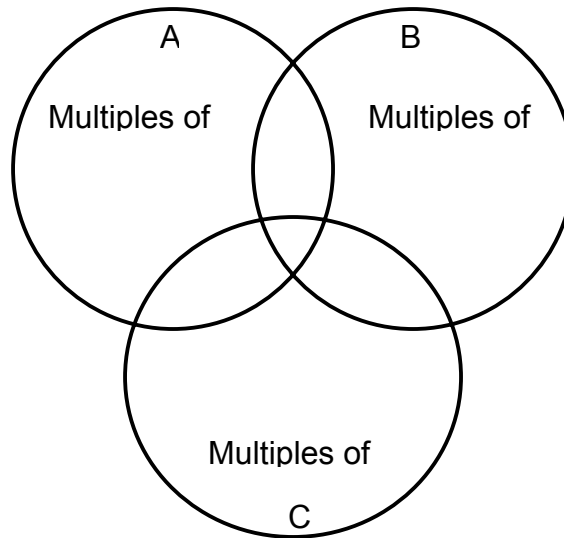
Students should:

1. Have knowledge of Venn diagrams.

Problem 2:**Process Standards: 4.1 and 1.6**

Select two numbers that fit in A. Explain why the two numbers do not fit in B.

Select a number that fits in A, B, and C. Explain your number choice.

**Solution Notes:**

Numbers 3, 6, or 9 could fit in circle A. A student explanation might say, “ 3, 6, and 9 are not multiples of 12. “

Students might select 12, or any multiple of 12. Student explanations should refer to the numbers 3 and 4 being factors of 12, therefore any multiple of 12 will overlap circles A and B.

Prerequisite:

Students should:

1. Have knowledge of Venn diagrams.

Discrete Mathematics
What All Students “Should Do”
3 – 4

Written Benchmark: E

Create algorithms based on constructing meaning from explorations.

Problem 1:

Process Standards: 1.5 and 3.3

Smithville Elementary School received a grant to order 300 books for the school library. Only 278 books had arrived by the start of the school year. Ask students to determine how many of the books have not arrived. Ask students to share their solution process.

Solution Notes:

Accept any valid explanation.

Students might work left to right subtracting the two hundred from the three hundred. Then the seventy and eight may be subtracted.

“ $300 - 200 = 100$, I need to subtract 70 more so that would equal 30. Now I need to subtract 8 more which leaves 28.”

Discrete Mathematics

What All Students “Should Do”

3 – 4

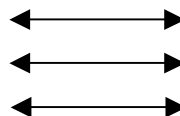
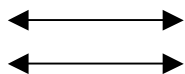
Written Benchmark: F

Determine a path through a maze, whether a street network could be traveled going over each street one time, and the shortest distance traveling on a network of roads or streets.

Problem 1:

Process Standards: 1.5 and 3.3

On the way home from soccer practice, Justin stops for ice cream. The arrows show the different routes that Justin can take from one point to another.



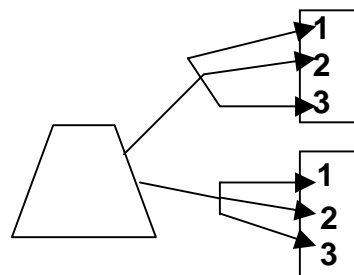
Home

How many different ways could Justin go home from the soccer field to the ice cream store and then home?

Solution Notes:

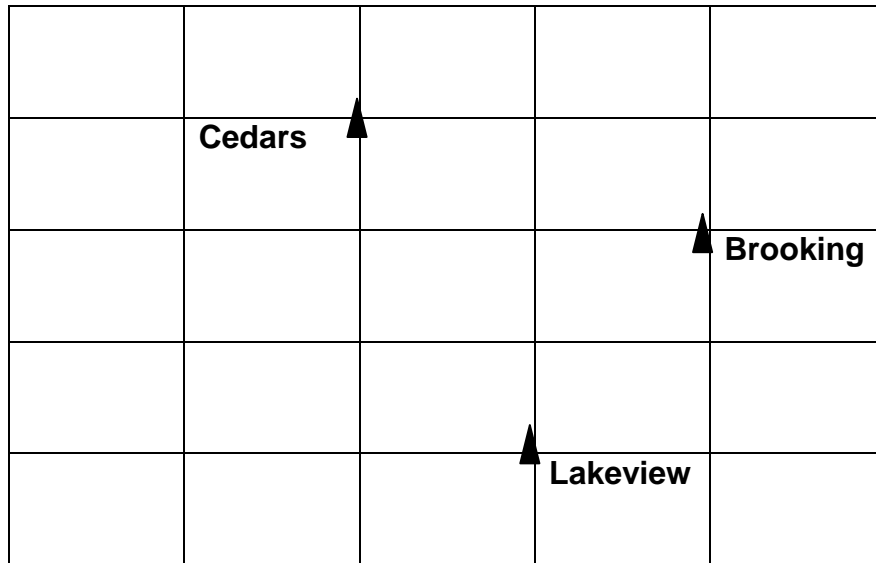
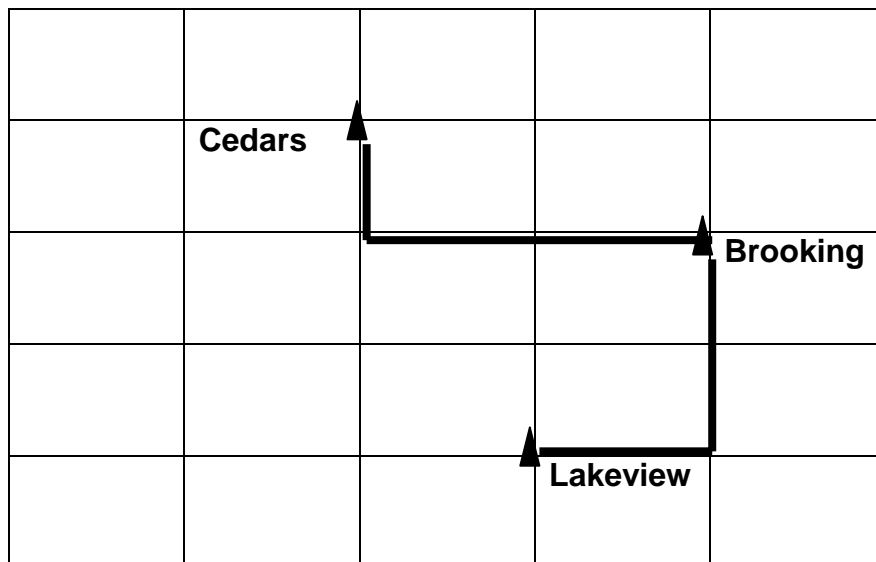
$$3 \times 2 = 6 \text{ ways}$$

Students may draw and count the six different ways.



Problem 2:**Process Standard: 3.3**

You must deliver mail to all three communities on the map below. On the map, draw the shortest path between these communities. Explain your answer.

**Solution Notes:**

The shortest distance that will connect these three communities is 6 blocks, or units.

Discrete Mathematics
What All Students “Should Do”
3 – 4

Written Benchmark: G

Apply the concept of fair division to real-world situations.

Problem1:

Process Standards: 3.3 and 4.1

The third and fourth grade classes are having a Spell Off. A total of 15 students can compete in the Spell Off. The third grade class has 24 students and the fourth grade class has 21 students. How many students from each grade will be in the Spell Off? Explain to your classmates how you fairly decided how many from each class will be in the Spell Off.

Solution Notes:

1. Eight third grade students.
2. Seven fourth grade students can
3. The third grade has more students than the fourth grade so they should have more students in the Spell Off.

Or other valid explanations. This activity could be done in cooperative groups, in pairs or individually.

